Illuminating Engineering Library

THE ILLUMINATING ENGINEER

LIGHT
LAMPS
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AND
ILLUMINATION

THE JOURNAL OF
GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

OIL
GAS
ELECTRICITY
ACETYLENE
PETROL-AIR
GAS
ETC.

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Special Features:

Papers on Illuminating Engineering—How the Architect can Aid the Illuminating Engineer—The Second World Power Conference (1930)—Street Lighting—Interior Lighting—A Survey of Shop Lighting—Floodlighting—News from Abroad, etc.

E.D.A.–E.L.M.A. SHOP AND DISPLAY LIGHTING CAMPAIGN

Arrangements have been made with The British Electrical Development Association to conduct a National Shop and Display Lighting Campaign during the Autumn of 1930

Full details of this Campaign can be obtained from

The British Electrical Development Association
15, Savoy Street, London, W.C. 2

Issued by the Electric Lamp Manufacturers' Association
Lighting Service Bureau, 15, Savoy Street, W.C. 2

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Papers on Illuminating Engineering

AT this period of the year, when preparations for the next session of the Illuminating Engineering Society are being made, we have been asked to make some suggestions regarding the kind of papers that would be welcome. With the aid of Mr. A. Cunnington, Chairman of the Papers Committee, the following notes have been prepared.

The field dealt with by the Illuminating Engineering Society is very wide, and it may be best to begin with a rough classification of types of papers. One might divide papers into those (1) contributing results of original research and investigations and bringing to light new facts or describing new processes, (2) embodying artistic efforts and creations which appeal to the senses rather than the intellect, (3) elucidating principles of correct lighting, (4) describing methods used in illuminating engineering, (5) illustrating applications of light in daily life, (6) containing information of special uses of light, other than for ordinary purposes of illumination, and (7) presenting statistical data.

All these types of papers are useful. Those falling under (1) and (2), embodying original effort, would probably do most to bring credit to the Society, by showing that the information presented at its meetings could not be found elsewhere. Such original investigations may take many forms. They may record new advances in illuminants and in illuminating apparatus or new principles in applying light in the services of mankind, or they may be undertaken to show the *effects* of varied conditions of illumination. In this last field much remains to be done. Rules for good lighting are based on general experience, but only in a few cases have we available detailed scientific evidence proving that injury to health or vision or loss in efficiency follows when these rules are transgressed. If, for instance, trustworthy data could be presented showing, by actual experience, that the work of children in schools or workers in factories deteriorates, or their health suffers, when illumination falls below a prescribed value, this would place illuminating engineers desiring better lighting in a much stronger position.

Papers dealing with artistic creations (2) naturally involve illustrations and demonstrations. The higher aspects of "architectural lighting" and the use of colour effects on the stage and in the kinema theatre, exhibition and spectacular lighting are all subjects with great possibilities. In domestic lighting also more consideration is now being given to decorative effects than in the past, and novel types of fittings for the lighting of the home, which deserve discussion, are now being introduced.

Papers dealing with general principles of lighting (3) would also be welcome. The Society does not consist exclusively of experts, but includes in its ranks many users of light to whom even fundamental principles may be unfamiliar. The work of the Society should be partly originating and partly educational, continually bringing the importance of good lighting before new sections of the public. Of special importance in this connection is the revelation of the part played by the human eye, and its susceptibility to glare, contrast, and other phenomena. Papers dealing with methods (4), e.g., practice in the photometric laboratory, methods of planning lighting installations and preparing specifications, etc., are likewise educational. But here, too, there is room for new information—for example, in connection with the use of photo-electric methods in photometry—a process now in course of development.

Applications of light in daily life (5) cover a very wide field indeed. The lighting of homes, offices, schools, factories, streets, railways, etc., offers endless opportunities of illustrating the skilful use of light and revealing incorrect methods which need to be remedied. New fields for lighting are constantly developing. Instances are the lighting of aerodromes and aerial routes, the use of luminous signals for traffic control, and the lighting of large areas devoted to games and sports.

The design of motor-car headlights may also be mentioned as an outstanding problem, in view of the great technical difficulty in providing an efficient driving beam, and at the same time minimizing glare to other users of the road.

Special uses of light (6) include such problems as the use of light in horticulture, effects of ultra-violet light (medical and industrial), the application of artificial light in photography and the making of films, and the possibilities of television.

The final division (7) may appear dull, but it is in reality extremely important. During recent years the Society has had before it several informative papers reviewing shop-window lighting and the lighting of engineering works and textile mills. Such surveys are informative, not merely in revealing opportunities for educational effort in favour of better lighting, but also in showing the most common faults that need to be rectified. Similar surveys of street lighting in various cities might be equally interesting. A fruitful field for investigation

is the analysis of accidents. The official annual report shows, in almost all cities, a continual growth in the number of street accidents. What proportion of these occur at night, and does this proportion show an undue increase year by year? Can those cities which have an unduly high accident rate be shown to be badly lighted? What data are available to show the influence of luminous traffic signals on the frequency of accidents? All these are queries which might be at least partially answered for cities in which the sympathetic co-operation of local authorities can be secured.

Similar data for factories might prove of considerable educational value. An interesting paper could be prepared analysing industrial accidents attributed to poor lighting, and estimating the total loss, direct and indirect, thus caused.

Finally, there are three aspects of papers which we should like to emphasize. Firstly, the Society is continually trying to arouse interest in illumination in new circles. Therefore, when a paper is such as to interest definite groups of people, its value is increased proportionately. It is now a number of years since the Society had a paper on hospital lighting. A paper on this subject would be opportune, and would be of obvious interest to the medical profession. Again, whilst industrial lighting in general terms has been discussed, there is ample room for papers dealing with the detailed requirements of certain industries, and inviting the help of their representatives in the solution of its special problems.

Secondly, there is every prospect that in the near future branches of the Society may be formed, especially in the Midland and North-Western areas. Papers on subjects of special interest, which could be read first in London and then at a local centre, would therefore be particularly acceptable.

Thirdly, we may draw attention to the continual growth of the illuminating engineering movement in other lands. The Society has already a number of members scattered over the face of the globe. We feel sure that papers showing what is being done in their localities would be especially welcome.

The programme for the next session is now being prepared. We understand that papers on the lighting of repair shops, offices, and large liners are expected, and that, as usual, one evening will be devoted to a series of problems in illuminating engineering. The Papers Committee has, however, intentionally left a number of dates vacant, so as to afford an opportunity for the offer of papers. We hope that their invitation will meet with a good response, and we take the opportunity of reminding members that papers presented during the coming session will, it is hoped, be eligible for the "Leon Gaster Memorial Premium."

Illuminating Engineering at Blackpool

Reference is made elsewhere to the Advertising Convention, at which several papers of interest to illuminating engineers were read. At the recent C.E.A. Conference in Blackpool, lighting effects were also discussed in two papers by Mr. R. Gillespie Williams and Mr. L. G. Applebee. The former dealt with colour-lighting, and endeavoured to answer several pertinent questions bearing on its use in the picture theatre. Mr. Applebee discussed the design of screen curtains and their illumination by changing light, raising such interesting points as the possible use of ultra-violet light for fluorescence effects, the best texture for colour lighting and the possibilities of travelling battens. It is interesting to observe how the discussion of special lighting problems is becoming a feature at congresses devoted to widely different topics.

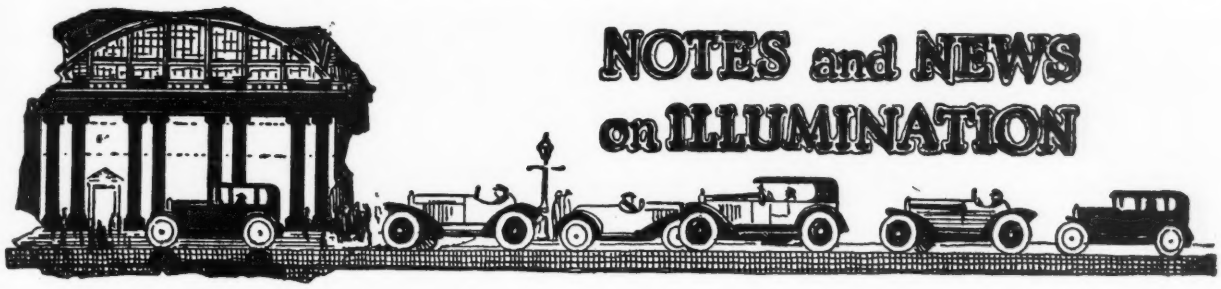
How Architects Can Aid the Illuminating Engineer

THE wish that architects should take a deeper interest in the artificial lighting of buildings, and especially the possibilities of light for decorative treatment, has been widely expressed. It would, however, be helpful if illuminating engineers would state more precisely what they desire the architect to do. In this connection the suggestions made by Messrs. H. H. Magdsick, Mr. Ward Harrison and others, in recent issues of the *Electrical World*, are of interest. The primary need is well expressed by Mr. A. L. Powell, who points out that the new developments in lighting afford architects an opportunity of expressing themselves in new ways. Lighting should be built into the architecture and should not appear as a crude afterthought. Plans for the provision of lighting and service facilities should be commenced as soon as the general design of the building is determined. But this will only come about if the architect feels that the lighting is of definite interest to him; if it is left to the efforts of the engineer after the building is complete it necessarily becomes an excrescence, foreign to the architect's design.

Amongst the more recent devices mentioned are the use of luminous panels in ceilings and walls, the use of beams of light to accentuate special ornamentation, the design of special decorative lighting units, stairways and pillars built out of luminous material, changing colour effects, etc.

In external lighting the co-operation of the architect is specially needed. Many buildings appear much more striking when floodlighted than they do by day. But the order of illumination may need to be higher than is generally assumed. Mr. Magdsick suggests that at least one watt per square foot should be allowed for modern floodlighting. Buildings should be adapted to receive signs which their clients may need in the future. Signs will then become an integral part of the design and less obtrusive than at present. Recesses measuring 8 ins. by 3 ft. by 15 ft. should be made above frontages of shops. Two rows of anchored supports on the corners of buildings may prove valuable for the support of permanent signs, and may avoid much costly subsequent drilling for the insertion of supports. Studs for anchoring roof signs may cost as much as £10 apiece if put in as an afterthought, whereas, if installed initially, they need cost only a fifth of this sum. Special provision should be made for additional lighting on festive occasions. Stainless steel ornamental supports should be provided 20 ft. to 30 ft. apart at the corners of buildings on the first and second floors and every two or more floors above. Service outlets should be available 25 ft. apart near the window-sills and at the back of parapet walls, using marine type fixtures, central control and wiring capable of providing 2 to 10 watts per sq. ft. All these suggestions of Mr. Magdsick's, which involve some forethought, help to minimize expense of installation.

Mr. L. A. S. Wood suggests that the services of architects should be secured in order to ensure the choice of standards of pleasing type for public lighting and the adoption of one uniform plan. In one American city there are 45 varieties of street-lighting standards. At present only 1 to 1.25 dollars (4s. to 5s.) per capita is expended annually on street lighting. An additional 1.50 dollars (6s.) per capita would make an immense difference, and would enable social and traffic requirements to be met as safely by night as in the daytime.



Reflection from Road Surfaces

The nature of the road surface is recognized to play an important part in street lighting, though it is, perhaps, hardly sufficiently realized how greatly the distribution of brightness may depart from that deduced from the calculated illumination. The extent of this variation is strikingly illustrated in a research recently conducted by Mr. A. K. Taylor at the National Physical Laboratory.* The surfaces studied included sand carpet, tar macadam, rock asphalt and wood paving. The three last types of surfaces readily become polished by the action of wheels of vehicles, but even the sand carpet is very far removed from a perfect diffuser. The surface usually adopted in city streets is both dark in texture and polished. One sees reflected images of the light-sources so that the effect on the eye may depend more on the brightness of the source and its position than on the distribution of illumination. Objects on the road are perceived largely as silhouettes. In wet weather the effect is accentuated and the polished reflection may give rise to troublesome glare; this point has, in fact, been mentioned to us as a distinct drawback to central suspension. We understand that the concrete road surfaces widely adopted in the United States, which are lighter in tint, give much better results. If a white dressing material could be discovered diffusion of light would be aided and effects of polished reflection would be less pronounced. At the moment the production of such a material may seem visionary, but the possibility is so important to the public lighting engineer that it ought to be kept in mind.

The Advertising Convention

The Advertising Convention held in Hastings during June 21st to 25th was attended by over 1,000 delegates and upwards of 70 addresses were delivered. It is stated that those present were responsible for an annual expenditure on advertising of about 180 million pounds! The addresses covered a wide field, and many leading figures in the advertising world were present. We are glad to notice that the part played by signs in modern advertising was not overlooked, though more might perhaps have been said on the value of light in general as a means of publicity. Mr. E. Emmerson, a past President of the Master Sign Makers' Association, read a paper entitled, "Signs; their Part in Modern Advertising," and Mr. J. M. Woolnough dealt with modern developments in the electric sign. Advertisers perhaps hardly appreciate sufficiently the possibilities in this field and the need for skill in the design of illuminated signs. We notice that the June *Signs* contains an article by Mr. H. S. Coleman pleading that more encouragement to the sign maker might be given by electric supply undertakings in this country. It is stated that the Boston Edison Company recently added nearly £1,000 to its revenue from one short campaign, and that in general each £100 spent on sign installations means an expenditure of about £15 per annum on electric current—surely a fact of significance to electrical undertakings. Sir Francis Goodenough was responsible for two papers at the convention, "Sales Management as a Career" and "Co-operation between Manufacturers, Advertising Agents and the Press in Market and Business Research." Mr. C. Pinkham, publicity manager to the General Electric Company Ltd., took for his subject "The Service expected from a Trade Journal"—a paper which technical journalists should not overlook.

* "Illumination Research." Technical Paper No. 9. Published by H.M. Stationery Office; 6d. net.

The Conference of Holophane Overseas Agents

We give elsewhere an account of the proceedings at the above conference, which took place during July 7th and 8th. The conference on this occasion was of a special nature. Twenty-four countries were represented, and one had the pleasure of meeting visitors from such distant lands as, for instance, Australia, the Argentine, Poland, Czecho-Slovakia, Egypt and Turkey. It must be rare indeed for a firm in this country to assemble agents from so many different quarters of the globe. An enterprising feature was the invitation extended to several outsiders prominently identified with various aspects of illumination. Addresses were delivered by Dr. J. W. T. Walsh (President of the Illuminating Engineering Society), Professor J. Teichmüller (Director of the Lichttechnische Institut, Karlsruhe), Mr. Howard Robertson, F.R.I.B.A., and Mr. Gray Wornum, F.R.I.B.A. (President of the Architectural Association). At the dinner which took place at the Trocadero on the evening of the opening day Mr. A. P. Trotter made one of his rare appearances in London and gave a characteristic address recalling early experiences of illuminating engineering. The conference was concluded by a delightful trip, on the invitation of Mrs. H. Hepworth Thompson, to "Magna Charta," the historic residence of the managing director. One was struck by the keenness with which problems were debated and friendly intercourse made light of linguistic difficulties.

The E.D.A.—E.L.M.A. Shop and Display Lighting Campaign

We have before us the announcement of the campaign on the above subject which is being launched this autumn. The general lines will follow those successfully adopted in the case of the Factory and Workshop Lighting Campaign (1928-29). The campaign aims at the replacement of obsolete shop-lighting equipment, and the encouragement of lighted shop facias, floodlighting, illuminated signs, after-hour lighting, etc. The importance of the subject to shopkeepers is obvious, and a leaflet has been issued containing arguments in favour of better shop lighting. A comprehensive scheme of propaganda is being prepared, and direct mail postal communications will be sent to about 200,000 shopkeepers comprising letters, booklets and reply postcards. Local demonstrations, shopping weeks, competitions, etc., are contemplated. In order to illustrate the need for educational effort the results of a recent survey of shop lighting are quoted. From this survey it appears that (1) only one shopkeeper in eight uses an outside electric sign, (2) less than one shop in 100 makes use of an illuminated facia, (3) only one shop window in ten is provided with a 100-watt lamp or its equivalent per foot run of window, (4) only 50 per cent. of the shop windows throughout the country are furnished with modern lighting equipment, (5) only one shopkeeper in five is making use of after-hour lighting and (6) only one shop in 20 has illuminated showcases.

British Standard Specification for Carbon Filament Electric Lamps (No. 33-1930)

The above specification, which supersedes No. 33-1906 has now been issued. Copies of this specification (price 2s. net; post free 2s. 2d.) may be obtained on application to the British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

Street Accidents and Public Lighting

Our note on the above subject in our June issue (p. 139) has brought us a letter from M. H. Maisonneuve, director of the *Service d'Etudes et d'Applications* of the *Compagnie des Lampes*. M. Maisonneuve quotes some interesting statistics furnished by the *Préfecture de Police* for the Seine Department of Paris. 639 persons lost their lives as a result of street accidents during 1929 (328 in Paris and 311 in suburbs). What is particularly striking to note is the very large proportion of accidents occurring during the period 16 to 20 h. (i.e., 4 p.m. to 8 p.m.). If one excludes this period the average number of accidents every two hours is approximately 41. On the other hand for the two hours 4 p.m. to 6 p.m. the average was 98—an increase of 140 per cent., and for the two hours 6 p.m. to 8 p.m. 132—an increase of 222 per cent. It may perhaps be urged that 4 p.m. to 8 p.m. corresponds with a "rush period" when people are returning to their homes, but it is curious that there seems to be no similar predominance of accidents during the similar morning period when people go to work. There seems more justice in emphasizing the fact that during a great part of the year this is a period of failing daylight when artificiai light is used, and the figures afford strong presumptive evidence that inadequate artificial lighting is a factor of importance in causing street accidents. Late at night and in the early morning fatal accidents are naturally rare, as there are few people in the streets and almost no traffic. The *Compagnie des Lampes*, which has been taking up this question actively, recently organized a conference of officials connected with insurance companies who were urged (1) to agree to a diminution in the premium applying to factories which are considered well lighted and (2) to interest themselves in the artificial lighting of certain public streets where accidents are unduly frequent.

The Illuminating Engineering Society, Karlsruhe

The above Society held its annual gathering in Karlsruhe during June 27th to 29th. In accordance with the familiar method practised by the societies in Germany the gathering was devoted to a group of papers on closely related subjects. Thus Professor Kogel reviewed progress in photo-chemical illuminants sources as a possible ideal illuminant, Dr. Lux discussed the actinic qualities of various sources of artificial light, Dr. O. Reeb illustrated the applications of incandescent lamps for projectors and in kinema technique, and Herr H. Bertling demonstrated an "ortho-actinic" source for photographic work. Other contributions dealt with the application of light in the epidiascope (Dr. H. Naumann) and with mercury vapour lamps (Dr. Graffunder). As usual, the conference was supplemented by agreeable local excursions.

Illustrating Applications of Light

We have previously commented on the large part that illustrations of installations now play in journals devoted to illumination. Foremost in the lavish use of striking pictures is *Light*. The Summer Number contains some effective views of interiors by Mr. E. W. Commery, who has developed a method of photography which is very successful in showing natural contrasts and yet revealing the sources of light without halation. There is a remarkable series of descriptive photographs showing what can be done with light in a really well-equipped motor car, and there are striking pictures showing the part played by artificial lighting in enabling various games (baseball, football, hockey, etc.) to be played by night.

Architectural Lighting

In the May issue of *Lux* there is an account by M. Marcel Hercat of methods of lighting adopted at the Barcelona Exhibition. Most articles on this topic have been concerned mainly with the magnificent out-of-door effects. M. Hercat, however, illustrates some pleasing interior lighting that deserves to be described as "architectural" and he also brings out the point, which is apt to be overlooked, that the exhibition was intended to be instructive in regard to ordinary lighting practice. He refers, for example, to demonstrations of lighting in the home and to the "Street of Light" which was contrived to illustrate modern methods of lighting show windows. A feature was the use of picturesque illuminated façades. In *Illuminotecnica* reference is made to the Exhibition of Decorative and Industrial Art at Monza. A feature is the "gallery of illumination," where varied applications of light are staged. Signor Antonio Ramelli has a suggestive article in the same issue on bedroom lighting, the provision of light for the bed and the dressing table being devised on novel principles and the furniture also original in design.

Building Prosperity Avenue

In a paper under the above title, now published in the *Transactions* of the Illuminating Engineering Society (U.S.A.), Mr. H. H. Magdsick gives some striking examples of modern display lighting. A feature of the latest installations is the manner in which illuminated signs are incorporated in the design of the building. Light can be used in various ways to embellish the architecture and to render a building a more striking and attractive object by night than by day. It is even possible by ingenious devices to cause an apparent change of form. For example, if, behind a sheet of opalescent glass, rods are placed with a single row of lamps behind them, the width of shadows and the brightness of the illuminated parts can be so controlled as to give a luminous panel a cylindrical appearance. Some effective illustrations of American buildings are presented, but the author goes further afield. He reproduces, for instance, some of the fanciful animated signs depicting jungle scenes, incidents in fairy tales, etc., due to the ingenuity of M. Jacopozzi, which are a feature of Christmas displays in Paris. Other original Continental displays include the Lichthaus Luz in Stuttgart and a co-operative store at the Hague, built mainly of glass, which is in substance one big illuminated sign by night.

A New Use for Floodlighting

The *New York World* recounts what is surely one of the most original applications of floodlighting. The manager of an hotel at Pasedena, California, experienced much annoyance from the croakings of bull frogs in his lily ponds. Every effort was made to diminish their number. Ducks were introduced, prizes were offered to children for frogs captured, men were hired to shoot them with rifles. But the final solution came from an unexpected quarter. Learning that frogs sing only in darkness he installed projectors to floodlight the ponds. "Now the frogs, baffled by science, sit dumb, vainly awaiting the curtain of darkness which never comes, whilst the guests sleep undisturbed."

TECHNICAL SECTION

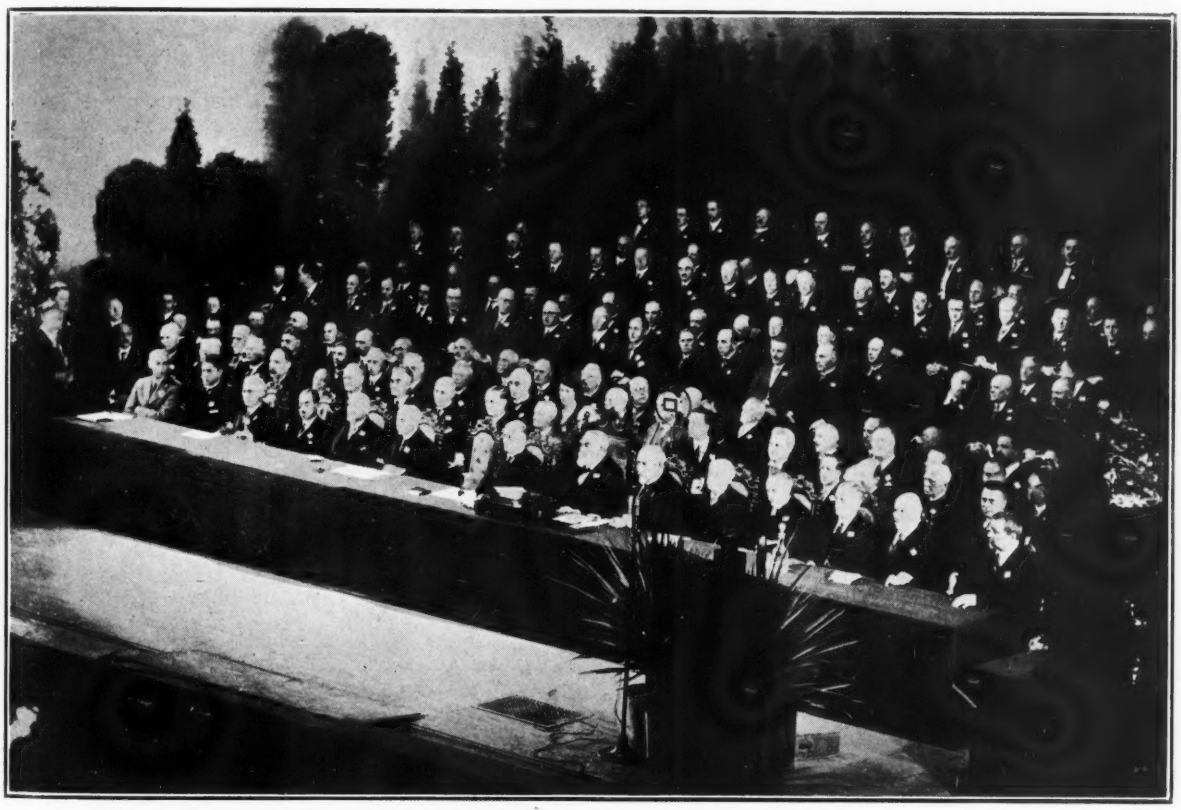
COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The Second World Power Conference (1930)

By An Engineering Correspondent



A Photograph taken at the Opening Session of the World Power Conference in the State Opera House, Berlin. Dr. O. von Miller presided. On his right are Dr. V. C. Köttgen (the Acting President), Sir Chas. Parsons, Dr. Tissot and Dr. Camsell; on the left Chancellor Dr. Brüning, Dr. Thierry, Professor Kamo, Mr. F. C. Faraker, Dr. Oliviera and Mr. O. C. Merrill.

THE British Empire Exhibition, held at Wembley in 1924, was noteworthy in many respects, but probably served its most useful purpose by enabling the conception of Mr. D. N. Dunlop of a World Power Conference, supported by the delegates of many nations, to come into being. At this inaugural congress, representatives from all the leading countries interested in the generation, transmission, distribution, utilization and development of power took part. The subjects dealt with included power resources (both available and actually used, embracing water and steam power); solid, liquid and gaseous fuels and their preparation; engines of all kinds; power in industry and domestic use and for transport; the economic utilization of power resources, standardization; research and illumination.

This broad and solid foundation served for a sectional meeting at Basle, in 1926, at which the utilization of hydraulic power and waterways, the interchange of electrical energy between countries, the economic relations of hydraulically and thermally produced electrical energy, together with the use of electricity in agriculture and for transport, were reported on and discussed. Next followed a Fuel Conference, held in London in 1928, that attracted much interest, a large number of visitors and various useful papers, and was followed by lively debates. Finally, in 1929, Tokyo formed the centre for further discussion of these problems.

The Second Plenary World Power Conference, recently held in Berlin, followed generally the lines of the Wembley meeting, but was organized on a much larger scale. Its programme embraced power in all its aspects, and it was divided into 35 clearly defined sections. This conference served also to incorporate the results of the intervening sectional meetings at Basle, London, Tokyo and Barcelona. The care devoted to the preparations for this conference may be judged from the fact that about 300 of Germany's leading experts,

gathered from the universities, the technical institutes, Government Departments, industry and commerce, in co-operation with those of like standing and experience in the other countries represented, had drawn up the suggestions for the preparation of the papers to be submitted under the approval of the representative associations and committees of the different participating lands. Nearly 400 papers were presented. General reports were forthcoming, for each of the sections, summarizing the papers, emphasizing the noteworthy features, and concluding with general conclusions based on the matter submitted and outlining points on which it was desirable to concentrate the discussions.

This careful preparation enabled the conference to be an unqualified success. An official welcome was extended to visitors in the Reichstag building, on June 15th, by His Excellency Dr. Brüning, the Chancellor of the Reich. The conference was opened by the Earl of Derby, who had been President since the first meeting at Wembley, in 1924, and who handed over the insignia of office to his successor, His Excellency Geheime Baurat Oscar von Miller, Doctor of Engineering, *honoris causa*, the founder of the great German National Museum of Science and Technology. In doing so he remarked: "It should be a source of great pride to all associated with the conference that the first World Power Conference, inaugurated by the creative imagination and organizing ability of Mr. D. N. Dunlop, was one of the very first great international gatherings during which members of countries which had been at war, not so very many years before, sat down together in order to discuss their common objectives, to surmount their common difficulties and to help to rebuild a shattered world." Dr. von Miller, in accepting the Presidency, said that "he only dared to assume such a high honour owing to the fact that he was one of the oldest living engineers who, as long ago as 50 years, began to develop the then almost unknown water powers of the Alps and Carpathians, and who, by the establishment of the first long-distance power line from Lauffen to Frankfurt-a.M., took a share in opening up the transmission of energy over large areas." He further stated that the World Power Conference was a singularly well-suited medium for the promotion of the exploitation of the world's power resources, as, whether they were coal, oil or water, they constituted some of the greatest treasures which Nature provides for humanity.

The labours of the conference were conducted in the Kroll State Opera House, which, with its vast salons, reception halls and well-equipped reception, reading, writing, and refreshment rooms, was well suited to the large gatherings which commenced their sessions at ten each morning and continued until six in the evening. The opening meeting, as well as the addresses delivered by such eminent visitors as Dr. Einstein and Professor Eddington, took place in the gigantic auditorium. The President, the Vice-President, the Chairman, the Vice-Chairman and the National Delegates, and other distinguished members of the National Committees occupied the stage in the manner shown in our illustration.

The following message from the President of the German realm was read:—

"I herewith tender Germany's greeting to the World Power Conference.

From all parts of the world, from all countries of the globe, you have gathered here inspired by the one idea of mastering, more completely, in mutual effort, the forces of Nature and of rendering them serviceable to the interests and progress of mankind.

At its foundation the World Power Conference was the 'Technical League of Nations,' and indeed, nothing is better calculated to bind together the nations of the earth than reciprocated endeavour of this kind to further the common weal.

Interchange of thought promotes mutual understanding. Moreover, practical progress in the sphere to which your conference is devoted will also lead to closer relations between the nations. By developing the transport of power across political frontiers, engineering is about to exercise greater influence than ever upon the economic life of all people and to establish a closer connection than ever before between their economic systems.

You, as the leading workers in engineering, science and economics, will by your conference bring about an appreciative co-operation between Governments, the different elements of communal life, and yourselves. The supply of power, light and heat in ever new and improved forms will prove an effective means of animating economic activity; it will tend to reduce unemployment and thus to counteract the difficulties under which the finances of almost all countries of the world are at present labouring.

As honorary patron of this second plenary conference, it therefore gives me particular pleasure to greet you here. Germany cordially welcomes you to her industrial centres, where the struggle for recovery has been particularly severe; she desires also to give you a lasting impression of what nature and art have conferred upon her in the way of beauty.

With all my heart, I wish you success in your efforts—the success which the world expects from your endeavours!

VON HINDENBURG."

A reply signed by Dr. Ed. Tissot, the Vice-Chairman of the International Executive Council, was as follows:—

"Overwhelmed by their cordial reception in Germany, the second World Power Conference desires to tender to Your Excellency and to the German people their profoundest gratitude. They look upon the inspiring message you have kindly addressed to them on behalf of the German nation as a proof of your appreciation of their lofty aims, and also an appeal and renewed incentive to do their utmost for the benefit of mankind. The currents of energy coursing through this hospitable country are a symbol and afford a guarantee that the world is on the threshold of a new era of peaceful development through amicable and close co-operation of all intellectual, economic, administrative, social, educational and artistic forces. Again, Your Excellency, we thank you most heartily for your high patronage and your country's good wishes.

EDOUARD TISSOT."

Introductory speeches were subsequently made by Dr. Köttgen as the Chairman of the conference, Sir Chas. Parsons (the Vice-President) and the representatives on the General Committee of the nations officially co-operating.

That the cordiality of the German nation was not confined to the message of welcome or the possibilities of inspecting institutions and industries and enjoying the natural beauties of their country in the height of summer was evidenced by the reception accorded by the German Government, through its Ministers, to all the members of the conference in the Marble Festival Salons at the Zoological Gardens.

The international character of the conference was well demonstrated by the general addresses given in the Opera House by men of distinction from various countries. Dr. Einstein, in person, dealt with "Physical Space and the Ether Problem," taking up the subject of the universe from the time of Newton's philosophy and developing it through the Faraday-Maxwell field theory to the conceptions, now so well known, that he originated. The address of Professor Eddington, the eminent Cambridge astronomer, on "Subatomic Energy" proved equally fascinating, both in the description of the physical conditions existing in the sun and in the suggestion that when the coal age had run its predicted maximum period of another 700 years we should already have ceased to need ordinary fuel, and would probably be able to extract from a glass of water sufficient energy to run a super-power station for a year.

To the general regret, Mr. D. N. Dunlop, who may be described as the founder of this technical league of nations and who still acts as Chairman of the International Executive Committee, was unable to deliver his address owing to indisposition.

New forms of rationalization constituted the subject matter of the address by Dr. D. Serruys in the French "hour." The American "hour" proved one of the most interesting, a feature being the speech of the American Ambassador, who brought the following message from President Hoover:—

"I send cordial greetings to those present at the 'American Hour' of the World Power Conference, in Berlin. The imagination is stirred by the ever-widening field of knowledge and its practical application in the multiplying instruments of service to mankind. Civilized society depends in ever-increasing degree upon the spirit of inquiry and the utilization of scientific truth. Those who serve this cause serve the best interests of the race.

HERBERT HOOVER."

A general address was given by H. Foster Bain on "The Place of Minerals in a Power-controlled World," and a film was exhibited showing Thomas Alva Edison in his laboratory and his connection with the birth of the incandescent lamp.

The Italian "hour" included a valuable contribution by Professor G. Vallauri on "Electricity and Power," in which he deplored the exclusion of the Italian language from the official tongues of the conference, but this could be counted as a mere aside inserted in a valuable and critical statement.

Sweden had, in Dr. A. F. Enstrom, an able exponent of "Mechanical Power as a Factor in Culture." "The European Super-power Lines" was the subject of a fascinating contribution by Dr. Oscar Oliven.

The official languages were limited to English, French and German, and, by an ingenious telephonic arrangement, the speakers' words were simultaneously available in these three languages. Meantime the reception, writing, reading and other rooms used by the members resembled the Tower of Babel by the multiplicity of tongues in use.

The earliest sectional meetings, held in the afternoon of the 16th June, exemplified the important part illumination played both in the reduction of the cost of electricity supply and in the spreading of interest in the domestic and industrial application of electrically transmitted heat and energy. These matters are dealt with under a separate heading.

The presence of women engineers at the conference was an interesting feature. Mrs. Ilse Knott-ter-Meer, who is a Doctor of Engineering of wide experience, the daughter of an eminent manufacturer of motor cars, and the wife of a well-known electrical engineer, took a leading part and entertained on one occasion all the women engineers present, amongst whom may be mentioned Miss Haslett, the Secretary of the Women's Engineering Society.

After the strictly business hours, arrangements were made for the inspection of places of technical interest in the vicinity of Berlin, and in many instances demonstrations given of the operation of certain plants, as, for instance, the setting in motion and coupling to line of a 15,000 kw. Diesel engine driven alternator, installed at Henningsdorf for peak load and power factor correction, by remote control operation. Interspaced with these instructive visits, specialist evenings were arranged by the different German technical associations, during which they lavishly entertained their foreign confrères, such as the gas engineers, the electrical engineers, the fuel chemists, etc., while at appropriate times films were on view at the magnificent building of the Institution of German Engineers, describing important undertakings in various countries.

The first Wednesday evening was celebrated by the 3,900 members of the conference in the Sport Palace, an edifice remotely similar to Olympia, as a festival consisting of a banquet followed by the singing of the old German country songs by a choir of 600 female voices and the presentation, by 700 performers, of the national German costumes through the ages, while during the evening telephonic radio conversation was established with America and with Great Britain, the occasion concluding with dancing until past the small hours of the morning.

After the 10 busy days of sectional and other meetings, the members separated into groups, and such as had free time journeyed on different routes to interesting institutions, mines, carbonization and chemical works, power stations and industrial factories. All of them, by the end of the first week in July, had dispersed to their homes well satisfied with what they had done, heard and seen, and looking forward to the Third Plenary World Power Conference, to be held in the United States of America in 1936. J. E.

Illumination at the Second World Power Conference

By an Engineering Correspondent.

ILLUMINATION, although seemingly but indirectly connected with power, took an important position in the proceedings of the First World Power Conference at the British Empire Exhibition in 1924, being also supported by a meeting held in the Congress Hall at Wembley, under the auspices of the Illuminating Engineering Society, in which illuminating engineers from many parts of the world participated.

Although no sectional meeting at the Second World Power Conference was allocated to Illumination, nevertheless this subject took a noteworthy place in Section 1, which dealt with "Electricity in the Household and in Agriculture," and also in Section 2, where "The Application of Electricity to Crafts and Industries" formed the nucleus of the papers and discussions.

INCREASE IN OUTPUT RESULTING FROM BETTER LIGHTING.

A lengthy paper, entitled "Increase in Output Resulting from Appropriate Installation of Electric Illumination," was contributed by Mr. L. Schneider, who is associated with the German "Osram" Company and with the management of the "House of Illumination" (which is, in many respects, the equivalent in German of the "Elma" Lighting Service Bureau).

In this contribution, based on observed facts, he made clear that all productive operations in the world are dependent upon the power of vision and defects of observation are controlled by the conditions of illumination. Consequently, suitable lighting forms a most important factor in the working efficiency of the human being whatever industry or recreation he pursues. Illumination thus has a distinct commercial value, but both physiological and psychological effects need consideration.

It was unfortunate, he said, that so far only a few instances of the interrelationship between the labour yield and the quantity and quality of the illumination have been accurately determined. But it was noteworthy that in every case investigated it was proved that the quality as well as the quantity of the product had been notably improved as the result of better illumination, especially when it was applied in a manner suitable to the individual requirements of the work being done.

Special stress was laid by the author upon the various elements of illumination that secured the most useful power of observation. He recalled the communication he had made on this subject in 1927, and illustrated his research work by curves showing the interdependence of:—

(*a*) Discrimination power and total illumination; indicating that there was both a minimum and an optimum degree of the latter.

(*b*) The rapidity with which size, or shape, can be determined with various degrees of illumination,

taking into consideration the contrast between the illuminated object and its surroundings.

(*c*) The rapidity with which size, or shape, can be determined and the contrast which they have with respect to their surroundings under different degrees of illumination.

(*d*) The rapidity of observation of the shape and the magnitude of the image cast on the retina.

(*e*) The degree of illumination of the surroundings on the power of distinguishing shape when the light projected on the object under observation remained constant.

(*f*) The capacity of discrimination and varying degrees of glare.

A number of practical conclusions may be drawn from the survey of these relations, e.g., that:—

(*a*) The working capacity of the eye increases with the illumination available, and

(*b*) The degree of illumination should be related to the class of work undertaken. In the latter connection, it is pointed out that while hitherto an illumination of 50 lux was considered ample for office work, this should now be increased to 100* lux, and in places where the contrast between the written or printed matter and the paper is of the order of 1 to 2 this should be increased to as much as 150 to 200 lux.

Practical tests with varying degrees of illumination made in postal sorting offices where great rapidity was required owing to the large use, in Germany, of the express delivery post, were shown in diagram form. Similar investigations in coal handling and in typesetting were mentioned. The observations by Messrs. West & Taylor, in the latter field indicate that an illumination of 300 lux secured results equivalent to good daylight, and the immediate diminution of reliability caused by poor illumination was fully demonstrated.

Actual costs in the typesetting department of a printing works are given in the accompanying tables (A and B).

TABLE A

Illumination =	Daylight	300 Lux	100 Lux	20 Lux
Output	100%	100%	90%	77%
	RM	RM	RM	RM
Wages	1·35	1·35	1·50	1·76
Lighting at 20 Pf/kw.h. ...	—	0·09	0·033	0·008
Total of Wages and Lighting	1·35	1·44	1·53	1·77

The same disadvantage of inadequate illumination is shown if the current is more expensive, as shown in

TABLE B

Price of Current Pf/kw.h.	Equivalent in pence per B. T. Unit approx.	Daylight RM	300 Lux RM	100 Lux RM	20 Lux RM
20	2.4	1.35	1.44	1.53	1.77
40	4.8	1.35	1.53	1.57	1.78
60	7·2	1·35	1·62	1·60	1·78

From such data it may be considered definitely proved that on the basis of working efficiency, exclusive of other advantages, poor lighting is more expensive than good lighting.

Illuminating and Electric Signs as Factors in the Sale of Electricity.

The paper presented by Mr. C. W. Sully on the above subject was a timely one. The author emphasized both the engineering and the economic changes resulting from the increased consumption of current for illumination and advertising purposes, and made a powerful plea for favourable consideration of the price charged for electricity for lighting and allied purposes.

It pointed out that the question was no longer a simple one of visibility, but embraced other important factors such as: (1) Provision of "facility" lighting in factories; (2) decorative lighting in the home; (3) preservation of eyesight in offices and schools; and (4) commercial advantage of display illumination to shopkeepers.

Practice in factory lighting had materially altered during recent years. "Point lighting" has been largely superseded by general illumination, the latter being sufficient in degree to compare with daylight, but advantageously supplemented by local lighting for important detail work. In domestic life the illuminating engineer of to-day used light as a decorative medium, and it had become an essential element in the furnishing of the home.

The uneconomic parsimony which had hitherto detrimentally affected users, after dark, of schools and offices, to the undoubted detriment of eyesight, activity and general health, had now been replaced by the modern adoption of more and better diffused light. The advantageous sales-securing atmosphere endowed on showroom and shop premises by adequate illumination had been proved, and many shops now benefited by the use of artificial illumination during the hours of daylight, in order to accentuate attractively particular articles and to add advertising value to the premises. Street lighting had developed to meet the requirements of high speed and densely aggregated traffic. The height of sources of illumination was now being increased so that the whole road surface could be adequately illuminated, with the supplementary advantage of enhancing the attractiveness of the thoroughfare, especially where suitable decorative lanterns were provided for the lights. The distinctive designs now incorporated by architects in modern structures could, by the application of flood-lighting, be rendered visible during the hours of darkness and leisure.

All these causes combined to place the demand for lighting current in a new aspect. The growth of the demand for electricity for lighting purposes was typically illustrated by load curves of Glasgow City in 1908 and 1922. The increased demand had both improved the load factor and shortened the peak. Experience indicated that it was incorrect to assume that the development of the lighting load would only bring about an increase in peak load. On the contrary, it could be proved that the full development of the lighting load, while increasing the peak, automatically improved the load factor. The explanation lay in the fact that the better the artificial lighting conditions the longer the period of lighting. Figures were quoted from a London undertaking which almost exclusively supplied lighting units for shops and offices. Statistics showed for the year 1921 a load factor of 10.2 per cent. which, during 1929, increased to 15.4 per cent. The maximum demand had in this instance increased 51 per cent., with a simultaneous 50 per cent. improvement in the load factor.

Analysis of the field of application showed that when illumination was employed to the fullest extent the load factor obtainable from many lighting loads was well over the 30 per cent. secured throughout Great Britain. Lighting development in itself could bring about an amelioration in the circumstances of supply undertakings. The following possible sources of improvement were mentioned:—

Load	Load Factor Per cent.
Street Lighting	up to 50
Shop Lighting	,, ,, 50
Hotel and Restaurant Lighting... ...	,, ,, 40
Electric Signs in Central Areas... ...	,, ,, 40

A good indication of the advantages of lighting development was available from the most recent report of the British Electricity Commission, which stated:

"The present and previous returns show that the lighting and domestic load has increased from 564 million units in 1921-22 to 1,708 million units in 1927-28, i.e., has trebled in the course of six years; and that the revenue from this class of supply has grown in the same period from 41.5 per cent. to 53.2 per cent.

* 10 lux are approximately equivalent to one foot-candle.

of the total revenue from the sale of energy to consumers, although the average revenue obtained per unit sold has decreased from 5.75d. to 3.93d., i.e., by 41 per cent."

The hitherto somewhat unsatisfactory lighting load in factories was likely, if attention is paid to the recommendation of various British Government reports, to become both more remunerative and larger. Thus the increase from 7 to 20 foot-candles indicated in a recent official publication dealing with "Typesetting by Hand" would add 20 per cent. to the total demand, while the appreciation of the ability accorded to the worker of producing higher output and better quality with less waste would extend the period of utilization.

The influence of the general demand for electricity resulting from a modern installation of electric lighting in a street was instanced, and the rapid upward movement of the application of electric lighting to streets was illustrated by the figures tabulated below:—

Electricity used for Public Lighting in the Streets of Great Britain.

Year ending March 31st.	Millions of Units each year.
1921	48
1922	53
1923	62
1924	70
1925	82
1926	89
1927	97
1928	114

Sign lighting of all kinds was shown to be rapidly increasing. The interesting fact was mentioned that in the central area of a large town twelve signs consumed over 300,460 units in the year with a load factor of 22.6 per cent., while in the same locality nine flashing signs consumed 98.078 units with a load factor of 10.98 per cent. Moreover, the electric lighting, in an ordinary area of normal brightness, of a 16-sheet poster only added 12½ per cent. to the cost of displaying it. Theatres, cinemas and restaurants likewise used large quantities of light and were long-hour users. An instance was given of a large restaurant consuming 993,000 units in the year 1929, while another consumed 442,000 units and six small multiple teashops 100,000 units. The shopkeeper now utilized his windows by means of concealed lights, projectors, coloured rays and other entirely safe applications of electric light to such an extent that 100 watts per foot run of window was quite common, and even 500 was found in special instances.

The increased yearly consumption for shop lighting between 1921 and 1929, in a large city, was diagrammatically illustrated. The following table of the sales of electricity for lighting a group of shops in a central London area was also given as typical:—

	Yearly Consumptions 1925	1929	Percentage Increase
1 Outfitter	40,294	74,530	85
2 Hotel	10,461	14,966	43
3 Tailor	4,100	4,461	9
4 Tobacconist	3,039	4,675	54
5 Tailor	10,500	12,800	22
6 China Shop	5,223	6,771	30
7 Jeweller	15,247	26,923	76
8 Restaurant	32,748	441,966	1,220
9 Shoes	13,407	19,668	47
10 Shoes	17,401	26,402	50
11 Jeweller	14,142	41,186	196
12 Ladies' Outfitters ...	3,593	180,762	4,950
13 Jeweller	8,710	19,950	130
	178,865	875,060	80

and it was stated that a store hitherto consuming 10 kw. for lighting had now, by adoption of architectural methods of illumination, a demand of 105 kw. on two floors of 20 ft. frontage and 60 ft. depth, and an annual consumption of over one million units.

The author enhanced the value of his paper by pointing out the advantages of expert lighting service which enabled the consumer to secure the fullest possible benefit for any outlays made either for installation or maintenance.

The Economics of Lighting.

In the paper submitted by Mr. Bruno Seeger, entitled "The Economics of Lighting and Propaganda in the Electrical Industry," the author explained that the term "Economics of Lighting" was obvious when it was realized that all luminous sources used by mankind for indoor illumination necessitated both capital and maintenance outlay. He pointed out that in order to obtain the best results from daylight outlays had to be made to cover the cost of windows, the restricted height of buildings, the separation necessary for light circuits. Moreover, in all civilized countries life is enjoyed and utilized after sundown, hence primary consideration should be given to securing adequate artificial lighting at a reasonable cost.

The author pointed out that the provision of electric light was the original and primary aim of central electrical generating stations. Bright illumination served as an excellent permanent advertisement of the availability of electric current, and automatically led to its utilization for other domestic, industrial and public utility purposes.

After referring to the paper contributed by Mr. L. Schneider, mentioned above, the author defined the "Economics of Lighting" as the systematic utilization of suitable and ample illumination with minimum specific cost to such a degree that after deducting the lighting charges the maximum possible material and ideal profit is secured.

He stated that it was difficult to ascertain, from the statistics available in Germany, the exact proportion of energy consumed for electric lighting. In certain instances, however, where there was no other notable utilization of electricity, a close approximation to the amount used for lighting purposes was possible. Amongst the largest of such users in Berlin the following he mentioned:—

1. The ten-storey "Karstadt" block building, surmounted by eight-storey towers, the upper of which form steeples several floors high, clad with opalescent glass forming a night advertisement. Although provided with light and airy courtyards, this building utilizes much artificial light during the daytime and has a total demand of 1,200 kw.

2. The large "Gourmenia" Restaurant, which probably has a better load factor than the "Karstadt," demands 735 kw. for lighting purposes.

3. The "Titania" Kinema Palace which has 450 kw. for light and a good load factor.

The demand for electricity for lighting street thoroughfares, traffic control, illumination or house numbers, etc., covered nearly 4,000 hours per annum. This demand for current for purposes of illumination would continue to increase continually as knowledge of the value and applicability of electric lighting became more general. The necessity of developing a light-demanding feeling, or sense, amongst actual and potential users was enlarged upon. The author enumerated applications of illumination, the majority of which require current during daylight. Important were naturally the display windows and salerooms of the large general stores, the public rooms of restaurants and hotels, the large railway termini and other complicated buildings in which it is impossible to obtain enough daylight for economic occupation, the lighting of dark corridors, corners of workshops, staircases of flats and so forth. The illumination of public buildings throughout the hours of darkness, the increased illumination of roads and streets, following the use of more powerful units mounted high up and giving less shadow and lower diversity factor, the illumination of house numbers and street corner signs, and the identification by light of fire stations, fire call-boxes, ambulance stations, surgeries, and the premises of pharmacists, and the application of light for advertisement purposes.

The city of Stuttgart, which gives a special tariff for shop window and advertisement lighting, was instanced as having an enlargement in demand of 35 per cent. while the peak has only increased 10 per cent, followed in the subsequent year by rises of 52 per cent. and 26 per cent. respectively.

The paper also recounted propaganda methods suitable for securing "economics of lighting," and mentioned that courses of instruction to electricity works owners and officials, electrical contractors' associations and (what is of exceedingly great importance) lectures specially intended for architects had been given at the Technical College of Berlin, Electrotechnical Association, by the German Illuminating Engineering Society and the League of German Architects.

Special attention was drawn to the work of Professor Dr. Teichmuller, at the Light-Technical Institute in Karlsruhe, where, since 1927, a special illumination demonstration hall had been available. The work of Dr. Geheimrat Wedding was also mentioned in connection with the spread of satisfactory economic illumination. The value of the work carried on at the Osram "House of Illumination" was illustrated by the following table:—

Year	No. of Lectures	No. of Audience
1925	109	9,140
1926	117	9,700
1927	125	10,400
1928	239	21,674
1929 (9 months only) ...	216	14,648

It was also stated that instructional courses given to master builders and others interested in building construction had met with great appreciation, and that several societies had now taken a hand in spreading information on illumination.

Concluding with a forecast of future possibilities, the author stated that sunlight could not now be regarded as the sole consolation for man, as artificial illumination to-day influenced very greatly the tasks of labour and the style of life, and this introduced new aspects into practical, social and ideal existence. The illuminating engineer would continue to strive for more economic light sources and better utilizing and distributing devices for them; the duty of the user of light would be to take every advantage of this progress. Only after this was achieved would humanity have reached the goal of perfect lighting.

Domestic Uses of Electricity.

The contribution from Mr. Marshall E. Sampsell, on "Developing the Domestic Use of Electricity," under the authority of the National Electric Light Association of America, was mainly an exposition of propaganda methods adopted in the United States. A brief reference was, however, made to a campaign, conducted in 1925, on "Home Lighting." This was inspired by the realization that there must be something radically wrong when the Eyesight Conservation Council of America stated that one-fourth of the children were handicapped by poor eyesight. A capital prize of $15,000 and many others in the form of scholarships and educational trips were offered in the leading national magazines; amongst other means of mass circulation "homelighting" lessons were made available at all electrical dealers. Educational competitions in the schools were likewise organized and a "Home Lighting" Primer produced. This campaign produced over one million essays on the subject from children.

This widespread activity, sponsored by the N.E.L.A., was energetically and enthusiastically supported by manufacturers of lighting equipments, distributors of current and other electrical organizations, who laid aside commercial rivalry for a broad constructive service to the public.

A useful diagram of the devolution of the activity from the inspiring body down to the "12,000,000 wired homes having interest and desire for better lighting and therefore better living conditions" was shown.

Electricity and Agriculture.

The communication from Mr. A. Petri, the manager of a Pomeranian rural distribution undertaking, on "Electricity in the Economics of the Home and Agriculture," contained mainly detailed information on heat and power appliances and their use. The interesting statement was, however, made that in the small four-room residences the consumption per head, per day, of electricity for illumination purposes is:—

Number of persons in the family	2	3	4
B.T. Units per head, per day	0·27	0·18	0·135
Monthly value of electricity sold for all purposes ...	16·53 RM.	17·50 RM.	20·53 RM.

These figures are regarded as proving the importance of light as an introductory medium for the sale of electrical energy for all purposes.

The use of electric light for forcing plants was mentioned as a promising development, although data are still lacking concerning the desirable intensity and period of the illumination. The well-known fact that the incandescent lamp converts but a small percentage of the energy supplied to it into luminous rays, the balance being thermal emission, is found to be a practical advantage in plant culture, as up to 70 per cent. of the heating current otherwise required is saved.

Mr. C. A. Cameron Brown, in dealing with "The Most Recent Applications of Electricity to Agriculture," stated that "artificial light had been used to stimulate the growth of plants and to improve the condition of animals," and referred to the book on "Electro Farming," by Mr. Borlase Matthews, in 1928. He also mentioned the researches of Messrs. Henderson & Magee at the Rowett Research Institute as showing that, under experimental conditions, semi-permanent stimulation and improvement of condition had been obtained, mercury vapour lamps being used as the source of the selected rays. The now widely spread use of electric light in poultry farming was instanced by the Winchendon farm of Mr. James de Rothchild, where each shed containing 100 birds was equipped with two 100-watt gasfilled lamps.

In the description of "The Electrification of an Extensive Farm," given by Mr. R. H. Drilhon, an interesting method of wiring the farm premises for electric light was mentioned. Provision was made everywhere throughout the farm for illumination, but an additional circuit, switch controlled solely by the farm manager, called the "patrol," lights a single lamp in each enclosure or other place where a pilot light is needed. This series of lamps enables the farm hands to switch "off" the lights for which they are individually responsible when leaving, and "on" when arriving, as they are never in entire darkness at such times, and is considered of paramount importance in the event of fire or other alarm occurring after dark.

It was interesting to hear Miss Haslett as certainly the first, if not the only, woman speaker at the Conference, recapitulate in Section 1 what was being done by the Women's Engineering Society and the Women's Electrical Association to promote intelligent interest in the application of electric lighting and an ample number of outlets for lighting, heating, or power appliances in the home.

The Glass Convention

An interesting event this autumn will be the Glass Convention, which is to be held in Buxton during September 17th-20th. The first Convention was held in Bournemouth, in September, 1928. Preparations for the forthcoming second Convention are being made and an influential organizing committee has been formed. Glass enters so greatly into modern lighting problems that the proceedings cannot fail to be of interest to members of the Illuminating Engineering Society. We understand that the Society has been invited to furnish a representative on the General Council. The Hon. Secretary of the Convention is Mr. Geoffrey Marchand, Aldwych House, Aldwych, London, W.C.2.

SPECIAL SECTION

The Conference of Holophane Overseas Agents

A Photograph taken during the Dinner held at the Trocadero Restaurant (Piccadilly), on July 8th.

FOR some years it has been the practice for overseas agents to assemble in conference at Holophane House. The conference which took place during July 7th and 8th was, however, of a somewhat special nature. In the first place the representation of other countries was exceptionally complete. On this occasion agents attended from Argentine, Australia, Austria, Belgium, Bulgaria, Czecho-Slovakia, Denmark, Egypt, Finland, France, Germany, Greece, Great Britain, Holland, India, Italy, New Zealand, Norway, Poland, Roumania, Spain, Sweden, Turkey and Yugo-Slavia.

In the second place a departure was made in inviting addresses by outside experts identified with various aspects of illumination.

Address of Welcome.

On the opening day visitors assembled at Holophane House in the morning. They were received by Mr. H. Hepworth Thompson, the managing director, who said that he counted it a great privilege to welcome such a unique assembly of the "Holophane family." The meeting was arranged primarily to afford opportunities of studying Holophane products and problems involved in their use, but another and equally important purpose was to give agents opportunities of meeting each other, so that the bonds of friendship might be strengthened.

An address entitled "Recent Researches in Illumination" was then delivered by Dr. J. W. T. Walsh, President of the Illuminating Engineering Society.

Recent Researches in Illumination.

Dr. Walsh referred to a number of outstanding problems. Researches on glare had occupied illuminating engineers for at least 25 or 30 years, and during the past five years work on this subject had been proceeding continuously under the Department of Scientific and Industrial Research. He alluded to recent experiments illustrating how the sensitiveness of the eye could be depressed by glare, and how the introduction of a glaring source in the field of view might increase the minimum perceptible change in brightness.

Another outstanding problem was street lighting, which again involved consideration of glare and also such questions as the effect of polished reflection from road surfaces. Amongst problems met with in ordinary illuminating engineering he mentioned the effect of a periodically fluctuating supply voltage in causing flicker.

A specification for the brightness of diffusing glass bowls and fittings was now being prepared by the B.E.S.A. Many experiments had been conducted and the results of some of them had been recently published. Artificial daylight was another topical subject. A distinction should be drawn between the approximate variety intended for clerical work and the more accurate correction involved in sources to facilitate colour-testing. The disadvantage of a "mixed" light (i.e., a mixture of natural light and uncorrected artificial light) for clerical work was familiar. The difficulty could be overcome by using an approximate imitation of daylight. Investigations on partially corrected light of this kind had been recently undertaken and formed the subject of a technical paper issued by the Illumination Research Committee (D.S.I.R.). Various systems were compared. The most favoured conditions were those furnished by an artificial daylight window.

Extensive experiments had been conducted in this country and America on problems connected with access of daylight into buildings. The proportion of window area to floor area, the correct design of interior light-wells and the automatic recording of daylight values were all being studied. An important investigation into the properties of different types of window glasses, polished, rough-cast, rolled and prismatic, had recently been completed. One important item was the transmission factor for "restricted diffused light," i.e., light incident at all angles between 45° and 90° to the normal.

Amongst other recent researches he might mention the protection of pictures (especially those painted in water colours) and museum specimens from the fading effect of daylight. The possibilities of protection by means of special glass opaque to ultra-violet light were being studied. The matter was, however, complicated by the fact that the degree of humidity had an important influence on fading, and it would seem that some control of humidity would be necessary. An alternative might be the entire exclusion of daylight and the substitution of artificial daylight.

In conclusion Dr. Walsh said that while this short sketch would show that much research was in progress, much also remained to be done. It was to be hoped that a continuance of the present happy co-operation between manufacturers, users and research workers would result in steady progress along lines which would be of the greatest benefit to the lighting industry and the community.

In the course of some discussion of Dr. Walsh's paper, Mr. Exelmanns expressed a wish to see comparative curves for the spectra of natural and artificial daylight. Dr. Walsh said that investigations on this point were proceeding. It was necessary first to decide upon a standard spectral distribution for ordinary natural light and then to determine how closely this curve could be imitated artificially; this would probably involve the examination of a number of different types of artificial daylight units at present in use.

Street Lighting.

The next item was an address on "Street Lighting," delivered in German, by Professor J. Teichmüller (Director of the Lichttechnisches Institut, Karlsruhe). In his opening remarks Professor Teichmüller pointed out that the problem of street lighting was continually extending, owing mainly to two facts, the ever-increasing speed and volume of traffic and the advances in technical possibilities of furnishing light.

The birth of the technique of the subject might perhaps be located near the end of the eighteenth century, when the great French chemist, Lavoisier, embarked on an extensive investigation of street lighting. The invention of gas lighting by Murdoch, in 1802, was a great step forward. However, progress for subsequent decades was slow, and the introduction of electric lighting towards the end of the century at first resulted in no substantial advance. Throughout that long period of time street lighting technique received but little study. Attention was concentrated almost entirely on efforts to improve the source. It was not until about 1890 that detailed projects for the lighting of streets and squares were prepared by Uppenborn in Germany.

At an early stage in the study of street lighting the question of the plane of measurement arose. Some considered that horizontal illumination should be tested; others urged that the illumination of vertical surfaces, such as street names and numbers, was more important. Differences of opinion likewise arose in regard to the degree of uniformity necessary, some assuming that illumination should be as nearly uniform as possible, whilst others attached more importance to the total amount of light furnished to a street. It will be noted that these factors could all be dealt with by physical measurement, and for long discussions of street lighting were governed by this purely physical method of approach.

It is necessary to emphasize that the solution of street-lighting problems depends essentially on the impressions received by the eye. The fact that it is necessary to cater for this complicated and sensitive piece of mechanism explains the fundamental difference between light technology and other technologies. The eye, like an incorruptible judge, renders the great service of revealing the errors of the expert. Not infrequently it refuses to recognize as good conditions of illumination designed and executed according to the expert's best principles.

Too much attention has hitherto been devoted to individual features of lighting quality to allow us to determine the significance of "quality of street lighting" in general.

In this connection Professor Teichmüller referred to the international discussion of street lighting at Saranac Inn in September, 1928. He attached considerable importance to this discussion as revealing expert opinion. Yet these discussions were concerned almost exclusively with such questions as the plane of measurement (whether vertical or horizontal or both). By far the greatest prominence was attached to lighting intensity and uniformity of illumination—in his opinion in excess of their true importance. Other contributory factors to street-lighting quality were only mentioned casually, and most of them regarded as matters not ripe for discussion at an international conference.

As an indication of what constitutes good street lighting he suggested that "a street is well lighted by artificial light if the moving and fixed objects in the street can be perceived with the same or similar clarity, and in the same or similarly attractive form, by such illumination as by fairly good (not 'bad') daylight illumination."

Even if we admit that perfect street lighting, according to this standard, will not be accomplished in the near future, or perhaps ever, this definition gives a clear goal towards which we ought to strive. This achievement may be realized in one of two ways, by empiricism, guided by the sense of sight, or by a scientific investigation of all the factors which contribute to "goodness" in lighting, and their influence as a whole. The second method is the one we should adopt, but we may be obliged to follow the first if progress in scientific investigation is slow. In Germany, however, some progress has been made. Efforts have been made to translate the valuable work of the great sense-physiologists (Helmholtz, Konig, Nagel and v. Krirs) into light technology. Mr. L. Schneider has established five basic perceptions involved in the perception of objects in the street, namely, difference perception, form perception (including keenness of sight), speed of perception, speed of difference perception, and, finally, speed of form perception. On the basis of these and other factors he has sought to establish rules for the lighting of arteries of modern traffic.

In time such investigations should provide us with an exact picture of the features composing the quality of a given street lighting. Other considerations include the effect of uncompleted adaptation on the various speeds of perception, and the effect of peripheral perception which really plays the part of visional *warning*. It is admittedly difficult to lay down indisputable rules for street lighting. Yet, as Mr. C. C. Paterson has truly observed, an industry and technology possessing no such rules will inevitably suffer. It is unfortunate that at Saranac no agreement was reached regarding the distinction between the graduation and valuation of street lighting, as suggested by Mr. Paterson. This distinction is important. Graduation, according to minimum horizontal illumination, is of questionable value. But two classes of streets can be distinguished immediately, i.e., those in which the sources serve to light rather than to illuminate, indicating the direction of streets and crossings as signal lights; and those in which the object of obtaining proper street illumination has been pursued and achieved.

From the æsthetic point of view it is unfortunate that axially-symmetrical lighting units are almost invariably used, whereas the elongated shape of streets demands illumination by non-axially-symmetrical units—a field in which the Holophane Company has been exceptionally successful.

The elimination of dazzle is surely another important object. Of great interest in this connection is the method of lighting devised by Mr. Ernst Holscher and installed in the Berlin Zoological Gardens. 500-watt lamps are mounted in a unit resembling a lily in shape, which affords diffusely reflected light. The system aptly illustrates the concept of "good lighting" in contradistinction to "intensive lighting." The horizontal illumination in the new part of the gardens thus lighted is probably lower than in the old part, yet the lighting obtained would doubtless be recognized by everybody as better.

It would be highly desirable to have frequent opportunities of contrasting different lighting installations in this way, observing the effects of "lighting quality," and thus analyse the individual part played by individual characteristics, the concept of lighting quality evolved varying according to the character of the street.

THE CHAIRMAN, in opening the discussion of the paper, deprecated an appeal to the judgment of the "man in the street," who was inclined to favour the installation that exhibited most glare and had little perception of æsthetic value. He preferred to work on a scientific basis, utilizing the results of measurement, and he still believed that the aim of producing substantially uniform illumination in a horizontal plane was a sound one.

M. KORDA (France) spoke with approval of the indirect lighting afforded by the fittings in the Zoological Gardens in Berlin. The effect was novel and arresting. Mr. KRAUTMACHER (Germany) compared these units to the "lily" fittings adopted on the Piccadilly Underground Station. The effect was pleasing to the eye but uneconomical, and was not suitable for street lighting. Mr. RIGBY (Australia) referred to experiences in Melbourne, where the authorities desired something decorative; they did not realize, however, that this inevitably meant less efficiency. Signor FERRARI (Italy) quoted experience in Italy where 100,000 Holophane units had been recently installed. He considered economic considerations very important. In Milan they had achieved a high degree of uniformity. Mr. E. STROUD (Great Britain) urged that ability to see objects on the roadway was the primary consideration. Intensity and uniformity were two basic values, susceptible of measurement, which had a direct bearing on the realization of this condition. No one would quarrel with Professor Teichmüller's definition of ideal street lighting, but it was quite unattainable at present. Until one could satisfy urgent practical requirements, one could not as a rule pay much attention to æsthetic effects. Mr. J. S. DOW (Great Britain) expressed his pleasure in again meeting Professor Teichmüller, whose ideas were always original and stimulating. He thought that the principle of measurement in a horizontal plane was established. Mr. Trotter, in his early work, had shown its utility, and had pointed out that while this method enables the effect of all the lighting units to be added there was no corresponding definite vertical plane which one could adopt. He did, however, agree with Professor Teichmüller in attaching great importance to avoidance of glare, which was particularly annoying in the case of peripheral vision. He believed that the trend of progress would be towards softer and more restful effects, even though some sacrifice in uniformity might be involved.

Professor TEICHMÜLLER, briefly replying to the discussion, remarked that it illustrated the conflict between two ideals of which everyone was conscious in dealing with illumination. He agreed that the goal of good street lighting, as he had defined it, was distant. But this goal should be kept in view. He realized that the installation in the Zoological Gardens was not adapted to streets. He had merely mentioned it as an instance of "good" lighting, pleasing to the eye. Present methods of street lighting were admittedly not free from glare. He felt sure that the Holophane Company, which had done so much for better lighting, would keep before them the desirability of diminishing glare still further.

KINEMA AND THEATRICAL LIGHTING.

Professor Teichmüller's paper was followed by a very pleasing demonstration by Mr. R. GILLESPIE WILLIAMS of colour-lighting. A series of demonstrations showed how entirely the appearance of coloured objects could be changed by modifying the coloured light impinging on them. This was illustrated particularly by the progressive changes in appearance of a drop-curtain, and by a mountain scene. In the course of his paper Mr. Williams remarked on the great advances in using colour during recent years. To the showman it was a most powerful weapon. It was not by chance that we used the word "colourless" to describe something flat and uninteresting. Instances of the growing tendency to make use of colour were evident in the auditorium of the theatre and in "atmospheric" effects in the picture palace. Successful colour-lighting could not be obtained with crude equipment. It demanded scientific methods. Yet the success of a scheme depended ultimately on æsthetic perception. Mr. Williams explained the distinction between the mixing of pigments and the mixture of coloured light, and emphasized the marvellous variety of tints obtained by the mixture of red, green and blue light. Dealing with stage lighting he discussed methods of obtaining correct distribution and shadow effects and described the Holophane footlights, which are highly flexible and capable of being sunk below the level of the stage. The paper was concluded by a description of the wonderful colour-lighting of the new Richmond Kinema Theatre, which was visited on the afternoon of the scond day.

SCIENCE IN THE SERVICE OF ILLUMINATING GLASS MANUFACTURERS.

After an interval for luncheon at St. Ermin's hotel the conference was resumed. A paper entitled "Science in the Service of Illuminating Glass Manufacturers" was read by Dr. S. ENGLISH.

In his opening remarks Dr. English recalled that in the literature of the past glass manufacture was always described as an "art." A famous old book was the *De arte vitraria*, by Neri, published in Florence in 1612, and in 1564 glassmaking was mentioned as one of the five "Black Arts." Glassmaking was still an art, but it was now something more, a technical science. More progress had been made during the past 30 years than in the previous 3,000. Since the last conference in 1927 many of the proposals then sketched out had been put into practice. It was then explained that the ordinary ingredients, sand and lime, invariably contained traces of iron whch gave to the glass a greenish tint. To decolorize the glass, manganese dioxide, giving a complementary pink colour, was added. But this decolorization, effected by adding colouring material, naturally involved increased absorption. It had been found possible to diminish the initial green coloration and the decolorizer to a corresponding extent. This had led to a distinctly brighter glassware, with as much brilliancy and sparkle as many forms of table glassware.

A further point of importance is that glass decolorized by the old method gradually becomes coloured under the influence of light. By taking the iron oxide green colour out of glass by chemical means, as distinct from physical means, almost colourless glass can be obtained. Artificial tests involving exposure to mercury arcs, equivalent to complete ageing and more exacting than exposure to daylight, cause no appreciable coloration. It is hoped to use this variety of glass very largely for street-lighting glassware. Greatly improved methods of annealing, giving better results and requiring much less time, have also been introduced.

In the next section of his paper Dr. English emphasized the need for greater resistance to high temperatures, as compared with that available 30, 20 or even 10 years ago, owing to the greater power and temperature of modern incandescent lamps. Thermal resistance is a complex quantity depending mainly on expansion, elasticity and tensile strength. Comparative figures were presented for 1926 and 1929 showing the advance made in all these three qualities. These tests were confirmed by experiments with actual reflectors, showing the greater difference in temperature now necessary to cause fracture. It is estimated that the power of the ordinary glass to resist variations in temperature has been increased by about 50 per cent. Special heat-resisting glass has also been developed for certain purposes; for instance, for use with street-lighting units using gas mantles. Directional refractor plates and one-piece refractors intended for use in circular lanterns have been produced. The thermal endurance appears to be ample even for these exacting requirements.

Progress has been made in yet another direction, durability or resistance to atmospheric corrosion. Some glasses are attacked by the moisture in the atmosphere in a few days. First a film of alkaline moisture forms on the surface, giving a "greasy" feel; at a later stage the surface becomes roughened and a white film develops. Glass which behaved in this way would never do for Holophane products, especially in countries where the influence of humidity is more severe than here. For several years efforts have been concentrated on improvements in durability, and the "figure of merit" has improved from 41.1 in 1926 to 278 in 1929. This means that if a piece of glassware produced in 1926 would withstand given climatic conditions for 10 years the present glass would withstand them for more than 50 years—an advance of considerable importance when the fact that the operation of the glassware depends on perfect working of the prisms is borne in mind.

Illumination From The Architect's Point of View.

An address on this subject was then delivered by Mr. Gray Wornum, F.R.I.B.A. (President of the Architectural Association of Great Britain). In his introductory remarks Mr. Wornum pointed out the desirability of firms in the lighting industry establishing relations with architects. A representative making such calls must, however, be completely familiar with their subject. He should know not only the work and methods of his own firm but of rivals as well. He recognized that architects were sometimes to blame for only calling in the illuminating engineers when their plans were completed. But in order to co-operate with the architect in the early stages of his work the illuminating engineer must first gain the architect's confidence. Architects were continually presenting new problems for solution, sometimes very difficult ones. It would help them greatly if they felt confidence in the lighting expert, and recognized that he shared and was interested in the architect's aims.

At the present time there were great opportunities for skill and ingenuity in lighting. He referred especially to the forms of diffused lighting which were now becoming usual. The art of the kinema involved considerations not only of light and shade but colour as well. In this connection Mr. Gray Wornum referred to several striking demonstrations of combinations of coloured light which he had recently witnessed.

Mr. Wornum suggested that there was need for variety in lighting. The man in the street should be encouraged to take an interest in the lighting of his own home. Unusual methods of lighting should not be dismissed as "stunts," for they might serve as amusements and kindle interest. At the same time an eccentric mode of lighting became wearisome if too long continued, and it was an advantage when lighting in the home was flexible, so that various combinations and experiments could be tried.

In conclusion Mr. Wornum again said that lighting experts could be of immense help to the architect if they knew their subject and could enter into his ideas. Architects had sometimes been unsuccessful with their lighting through want of such help; he did not see why there should be any failures if both could work together.

Modern Interior Lighting.

Mr. Howard Robertson, F.R.I.B.A., in an address on the above subject, endorsed the remarks of Mr. Gray Wornum. Lighting involved a dual problem, the provision of adequate illumination and the decorative effect, the solution of which required the collaboration of the technician and the artist. The importance to be assigned to the decorative element naturally varied according to the problem. In many cases there was no opening for the artist. But it would be observed that buildings were becoming less and less stereotyped. Offices, churches, public buildings, factories, schools, private houses—all needed individual study. Even factories differed greatly, according to the processes carried on. There might be wide variations in the design of buildings for different processes in the same industry. Churches, again, differed very greatly in lighting requirements, according to the nature of the worship, so that to-day there were very few cases where architectural and artistic problems did not arise.

In connection with utilitarian lighting such questions as general diffusion, absence of glare and local accentuation of illumination almost invariably arose. The treatment was mainly scientific, yet there was no reason why the lighting should be unsightly. He recalled a visit to a large factory in Holland. This was very pleasantly lighted. The fittings were satisfactory from the utilitarian standpoint, but they were also well designed and had genuine æsthetic value. In office and commercial work mobility might receive more consideration. Could not ceiling fittings be plugged in, in the same manner as wall lights, i.e., could not the ceiling be equipped with outlets so that the positions of lighting units could be varied as desired?

In decorative lighting, as Mr. Wornum had stated, the primary thing was early consideration of the lighting by the architect. To-day there were remarkable variations in treatment, as exemplified by recent installations in America, the ceilings and balconies at the Savoy Theatre, the novel lighting effects developed in France, and the conception of a building "built up of light," like the Titania Palast in Berlin. In that building fittings in the ordinary sense were almost non-existent. France had made a speciality of luminous panels built into the walls. The method was inevitably uneconomical, but was capable of very interesting effects. Germany had developed special ideas of lighting in which the existence of the fitting or lamp was accepted. No attempt was made to keep it out of sight, but on the contrary it was regarded as an object with decorative possibilities and an element in the general design.

Indirect and semi-indirect lighting of the type widely practised in England was apt to be depressing, unless counteracted by supplementary local lighting. There was a tendency to cut out visible lights and to adopt luminous panels on walls, artificial skylights, etc. This method had interesting possibilities. It was exemplified on the "Ile de France," where no sources of light were visible and a very restful effect was obtained.

In the home, as in other buildings, there were endless possibilities. Every fitting, to be effective in modern architecture, should be designed as part of the room in which it was placed. The effort to meet all tastes would impose considerable difficulties on lighting firms. Until architecture "settled down," it did not seem possible to evolve standard types. Special importance should be attached to shadows and moulding. It might be a good plan for the architect, before he approached the illuminating engineer, to draw a species of "shadow scheme" for his interiors, so that the conditions of light and shadow by night might be compared with those by day. Lighting depended on the size, shape and nature of the room, on the materials used for the walls, and on many other factors. Every single room required individual study, according to the purpose it served.

In conclusion Mr. Robertson emphasized the need for greater care in the design of fittings. In each country there were good features, but also defects. In France the fittings struck him as unduly fragile, sometimes difficult to clean and extravagant in the use of light, but clever in design. In Germany the metal work was sometimes poor, but the lamps were very efficient. In England the workmanship was usually sound, but the metal work sometimes showed poor design and there was less evidence of ingenuity. Generally speaking, foreign fittings were more attractive to look at. There seemed to be too much of the arts and crafts and too much of the antique in the designs found in England to-day. No doubt this was due in a large measure to the fact that buyers were not properly educated to appreciate good things. In order to develop modern lighting it was very important that the designer should travel and go about. He should not spend too much time in his office. He should visit kinema theatres, restaurants and all kinds of interiors and study the needs of different kinds of people so that he can put himself in their place and satisfy their require-

ments. Designers of fittings frequently had not the experience acquired by the architect in his travels, and sometimes one almost felt that they were not speaking the same language.

The CHAIRMAN referred to the width of view illustrated by Mr. Robertson's address. Firms in the lighting industry should recognize the need for wide experience of the kind he had described. The system of "plugging-in" on the ceiling had been tried in America some years ago, but had apparently died a natural death. His own experience of the lighting of the "Ile de France" was that it was depressing. In regard to home fittings there was perhaps a tendency to be too utilitarian, and the help of the architect would be welcome in designing something more decorative. But, as Mr. Robertson had pointed out, it was a difficult and complex problem to satisfy the needs of a home which required 101 different fittings at 101 different points!

Professor J. TEICHMÜLLER said that lighting specialists must share with architects the blame for insufficient co-operation. A new period had come. Artificial lighting had far greater possibilities than in the past. Architects and lighting experts must work together in order to apply these new methods in the correct way when new buildings were planned. "Architectural lighting" should be such as to express the work of the architect. In this direction shadows were of outstanding importance. In his institute he was continually impressing on students that mere technical facility in applying light is not enough. It should be used with insight and understanding, bearing in mind both the technical and the æsthetic standpoints.

HOLOPHANE DEVELOPMENTS.

A paper, reviewing progress in Holophane products, was next read by Mr. ERNEST STROUD, who recalled how new designs of prismatic glassware had been continually produced to meet new needs as they arose. Amongst problems of special importance to-day he mentioned street lighting, floodlighting, shop lighting, factory lighting, colour-lighting, spectacular lighting and architectural lighting. These and other problems were being constantly studied by his company, which was, perhaps, the only one in the world engaged solely in artificial illumination.

In connection with street lighting Mr. Stroud mentioned that Great Britain was the first country to issue a Standard Specification. This specification was necessarily framed to meet present conditions. As yet, considerations of economy led to lighting units being placed far apart. Lighting units had to be designed accordingly; hence the development of prismatic refractors to give wide lateral beams. When conditions allowed, closer spacing lighting units would be redesigned. In recent designs of directional units the prisms had been modified to give a wider lateral spread and a lower maximum intensity, the magnification being eight times as compared with 12—a change which helped to diminish glare. Lantern slides illustrating new forms of distribution were also shown.

Floodlighting was as yet in its infancy, but its advertising value was becoming increasingly recognized. New units, equipped with prismatic front lenses to give further control of the beam and diminish striation effects, had been introduced. Three main types, extensive, concentrating and rectangular, had been evolved to suit varied conditions. The types could be readily converted, one into another. A special unit for distant projection, taking lamps up to 1,000 watts, had also been developed. This was likewise divisible into three main types. At the other end of the scale was the miniature form, designed with special lens system to give maximum flux output with 100 to 250 watt lamps.

In the next section of his address Mr. Stroud dealt with reflectors adapted for different shapes of shop windows and factory lighting. Reference was also made to the recent development of prismatic plates, from which luminous panels may be formed. Such plates have been applied in picture galleries, but their most striking application is for providing the high illumination and shadowless light needed for hospital operating tables.

Final reference was made to "architectural lighting units" of original design, built up in various geometrical forms.

PRACTICAL APPLICATIONS.

The final paper, by Mr. L. M. TYE, discussed various practical applications such as the lighting of churches, schools, libraries, etc In church lighting considerations associated with architectural effect and tradition are of special importance. Numerous lantern slides were shown illustrating recent installations, special attention being drawn to the use of concealed lighting. In connection with school lighting it was pointed out that as yet no definite regulations bearing on artificial lighting had been made by the authorities. A standard of 5 to 6 foot-candles was, however, considered necessary. The lighting of a typical classroom, 22 ft. by 20 ft., was discussed and views of installations in various schools were shown. The installation in the Bodleian Library, Oxford, was described as a particularly interesting case. In this case an illumination of 7 foot-candles is provided In banks a recent development has been the wider use of general overhead lighting, instead of the local units hitherto considered indispensable. In industrial lighting conditions are governed largely by the tendency towards amalgamation into large factories for mass production. The introduction of high-speed machinery has made good lighting even more important than in the past. Illustrations showing the lighting of the works of Messrs. Jos. Lucas Ltd., where 30 foot-candles have been provided, were exhibited.

In the subsequent discussion of these papers Mr. SJOLANDER raised the question of the design of artificial daylight units, and M. KORDA (France) referred to forthcoming lighting campaigns in France, Switzerland and Czecho-Slovakia. Mr. BENZON (Denmark) contributed an interesting account of the use of artificial light to accelerate the growth of cucumbers, tomatoes, orchids, etc. Exposure to artificial light had had very beneficial results, and the expense was not excessive. It was, however, essential to get electricity at a low price, and the Danish electricity works had supplied at about ¾d. per unit.

On the proposal of M. KORDA a cordial vote of thanks was passed to the CHAIRMAN (Mr. H. Hepworth Thomson) for the efforts he had made in arranging the conference. This was carried with acclamation.

OTHER EVENTS.

A pleasant event on the evening of July 7th was the dinner held at the Trocadero Restaurant. After the usual loyal toasts, "Our Foreign Agents," "Holophane Ltd.," and "Our Guests" were celebrated. The last-named toast was associated with the names of Mr. A. P. Trotter, Mr. Gray Wornum and Professor Teichmüller. The former gave a brief account of the early history of prismatic glassware, which antedated the electric incandescent lamp. He recalled the great problem which presented itself, at a time when only arc lamps were known, as "the subdivision of the electric light." He, himself, sought to deal with the problem by distribution rather than subdivision, and worked out systems of prisms for the purpose. These ideas were illustrated in drawings which he took with him to the Electrical Exhibition in Paris in 1881, where he was rather disconcerted by the display of glowlamps which, not being point sources, did not fit in with his calculations. Swan had shown carbon lamps at Newcastle in 1877. He (Mr. Trotter) foresaw the subsequent progress of electric incandescent lamps, and devised diffusing flutings to produce what Professor Blondel afterwards termed "Holophane." In 1883 dioptric glassware, based on these principles, was manufactured and shown at the Crystal Palace. Such glassware was used to a great extent for lighting the Health Exhibition in 1884, and was awarded a silver medal. About eight years later Blondel and Psaroudaki were working on the same problem. This was only one of a number of occasions

on which, by a happy coincidence, he had worked quite independently on optical problems which Professor Blondel was also studying. Other instances were the study of matt and partially matt surfaces (1891) and the effort to base a standard of light on the selection of a definite area of the crater of the electric arc. It had been his privilege subsequently to become acquainted with that eminent Frenchman, whom they would all have liked to see present on this occasion.

Following the dinner a charming display of dancing, illuminated by changing coloured light, was arranged by Mr. R. Gillespie Williams. This display was witnessed with great interest and if—as is apt to happen when displays are arranged at short notice in hotels—the fuses occasionally failed to stand up to the extra demands made upon them, this was not wholly a drawback, for, as Mr. Trotter aptly remarked, it served to emphasize how absolutely dependent such displays are on the aid of the lighting expert!

The concluding item on the programme was a delightful excursion to Magna Charta, the residence of the managing director, where visitors were entertained to tea by Mrs. H. Hepworth Thompson, afterwards proceeding by motor launches up the Thames to the Old Bridge Hotel, Staines, where a farewell dinner was provided. In the course of the journey a halt was called at the Richmond Kinema Theatre, where visitors had an opportunity of examining the automatic colour-lighting devised by Mr. Gillespie Williams.* The trip afforded an excellent opportunity for all participating in the conference to improve their acquaintance with each other, and proved to be most enjoyable.

Some Impressions of Lighting in the United States and Canada

By An Engineering Correspondent

IN the course of a tour of various cities in Canada and the United States, in the early months of 1930, some notes were made on interesting features of the lighting. It was suggested to the writer that an account of these experiences might be of interest to readers of *The Illuminating Engineer*.

In the chief cities visited, over 20 in number, much of the ordinary lighting is naturally of medium quality, but in nearly all these cities instances of advanced lighting practice were observed. It may perhaps be convenient to record these impressions by dealing with various types of lighting in succession.

Street Lighting.

In nearly all cities in the United States one finds several main streets lighted on the "White Way" principle, the cost of which (about five dollars per ft. frontage) is borne mainly by the local merchants. In such streets decorative metal posts carrying several diffusing units are usual. 1,000 watt lamps are widely used, but the height of the lamps and the use of diffusing globes help to eliminate glare. Market Street, Francisco, where three arc lamps per post are adopted, struck one as an instance of special high intensity lighting. Smaller ornamental posts, frequently of reinforced concrete, are widely used, especially in the Californian residential districts. In Los Angeles alone 50,000 of these units are in use. The 6.6 and 20 amps. series-type lamps adopted for this form of lighting are very robust, and the combination of decorated post and diffusing globe is pleasing and effective.

The careful planning of streets aids very greatly the use of *luminous traffic signals*, which are a feature of nearly all American and Canadian cities. The success of these signals is assured, and it is stated that thousands of lives are saved annually by their aid.

Signs and Advertisement Lighting.

Much has been said on the signs of American cities. To the writer one of the most noticeable developments was the frequent use of neon tube lighting. In many main streets the majority of the signs are of this nature. Theatre signs are specially elaborate. By means of flashers the five or more available colours from neon tubes in various colours are occasionally used to outline buildings, but this effect is now considered crude.

Poster lighting has been developed to a high art. In many cases the lighting equipment is completely invisible by night. 200-watt lamps on 8 ft. centres equipped with white enamelled reflectors are used with good effect. Neon tubes are sometimes added to accentuate the chief feature, usually a single word, and are generally kept alight both by day and by night. Many of these examples of combined floodlighting and auxiliary luminous devices show great ingenuity. In some cases the effects are contrived on an imposing scale, e.g., the "Hollywoodland" sign on the hills north of Hollywood is executed in neon letters 50 ft. high and is more than a quarter of a mile long! Petrol stations declare their willingness to give service by means of neon tubing and adopt supplementary floodlighting. Luminous church signs and crosses are familiar. The city of Hamilton greets visitors by 80 ft. illuminated pictorial posters at convenient road bends emphasizing the attractions of the city they are about to enter.

Floodlighting, with the possible exception of the neon sign, is the most distinctive lighting feature in American cities. Many City Halls and municipal buildings are thus lighted. The towers of commercial buildings, flooded with white or coloured light, have a pleasing appearance against the night sky. Revolving beacons with white or multi-coloured light are frequently used for purposes of publicity and incidentally furnish useful observation marks to airmen.

Railway Stations.

The great terminal stations are usually highly modern in equipment and the lighting is equally up-to-date. Every effort is made to keep the travelling public warm, comfortable and interested. Luminous train notices and illuminated transparencies depicting the scenic wonders on railway systems are common features. At the Boston terminal station indication signs in blue neon lettering are used with good effect. Clock dials on the Ferry Building, San Francisco, are illuminated from behind by mercury vapour lamps, in striking contrast to the red neon beacon above.

Shop Lighting.

The chief feature of shop-window lighting in leading stores is the high intensity adopted. "Stunt" lighting with colours, etc., is little used. For shop interiors enclosed diffusing units are mainly adopted. In one large store, in Chicago, indirect lighting is used in the "bargain basement," but the effect lacks that "punch" desirable in lighting as a sales force. Striking example of indirect lighting in banks and insurance offices were seen; yet there seemed to be a certain lack of life even in the best of these.

Originality is frequently shown in the lighting of *hotels, restaurants and theatres*. Bedside lamps are usual in hotels, and other sources are as a rule well placed. Illuminated canopies are frequently adopted by picture theatres. At the Roxy's Theatre, New York, a series of indicators shows, by means of miniature lamps, which of the thousands of seats are occupied. The accommodation available in all parts of the theatre is thus visible to attendants. An outstanding example of library lighting is afforded by the New York Public Library, where thousands of readers assemble in large halls and study in comfort. Excellent general lighting is provided by electroliers using rings of frosted lamps; local lighting is furnished by inverted wooden troughs, equipped with diffusing glass and running the complete length of each table. This local source is quite invisible and the equipment harmonizes with the tables. There are many spacious museums and art galleries, some of which are illuminated with colour-corrected light.

H. E. H.

* A description of this interesting installation will be found in *The Illuminating Engineer*, June, 1930, p. 156.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

A Lighting Survey on a Large Scale

(Contributed by the E.L.M.A. Lighting Service Bureau.)

IN connection with the shop and display lighting campaign which the Electrical Development Association is carrying out in collaboration with the Electric Lamp Manufacturers' Association during the coming autumn, an extensive survey of existing shop lighting conditions is now being made.

A survey of shop lighting carried out by the E.L.M.A. in 1925 was reported in the issue of this journal for May of that year, but the present survey differs considerably from this in some respects. The 1925 survey was limited to some 800 shops in selected towns, whereas it is estimated that at least 20,000 shops will be surveyed before this autumn; all the principal towns in the country, and many of secondary importance, being covered. In order to accomplish this, the co-operation of the electrical trade throughout the country has been obtained through the E.D.A. Circle Organization, and through local committees set up for campaign purposes in towns where no circle exists. These local organizations decide upon several streets representative of main, secondary, and poor shopping thoroughfares to be surveyed; each member engaged in the survey being allotted one or more for his particular attention.

In such circumstances it has been necessary to confine the details surveyed to the window and exterior in order to make it unnecessary for the surveyor to enter any shop. Books of survey forms, a miniature one of which is reproduced on this page, are distributed to those undertaking the survey. The facility with which these can be filled up will be apparent, as it is only necessary for the surveyor to place a cross in the spaces provided opposite appropriate details. Any extra remarks which may be necessary are written at the foot of the form. In order to cater for the possibility of differences of opinion as to the definition of such terms as "Display Type Window Dressing," notes are given on the inside cover of each book of forms which will make everything clear.

Completed books will be returned to the E.L.M.A. Lighting Service Bureau, where the results of the survey will be tabulated and summed up, providing much more representative data on existing shop window and exterior lighting conditions than it has ever been possible to obtain previously. It is intended, after a sufficient period has elapsed, to make a re-survey on the same scale in order to ascertain what improvement has been brought about by the shop-lighting campaign, since this is being directed principally towards improvements in window and shop exterior display lighting.

A re-survey of those of the original 800 shops which are still in existence was undertaken during May this year, and it was found that although there had been a marked improvement there is still much room for a campaign with the object of improving the general standard of shop lighting in this country.

48 **FOR LONDON**

Date ..... *E.L.M.A. Ref. No.* .....

Name and .....

Address of Shop .....

Type of Shop .....

Closing Hours .....

SHOP WINDOW

Is shop in Main Street ☐ / Side Street ☐

Number of Windows ☐

Total Glazed Length of all windows ☐

No. and Size of Lamps. 25 watt ☐
40 " ☐
60 " ☐
100 " ☐
150 " ☐
200 " ☐
300 " ☐

No. of top reflectors or trough fittings .. ☐

No. of Drop Pendants .. ☐

Is window Dressing Close Window type ☐ / Display type ☐

Description of Special Lighting panels, luminous ornaments, etc., if any.

Remarks.

No. and Wattage of Window floodlights, if used .....

Is after hours lighting used? Yes ☐ No ☐

Is colour lighting used? Yes ☐ No ☐

EXTERIOR

No. and Wattage of outside lanterns, if used .....

Description of Facia Sign, if used .....

Description of outside sign, if used

Description of flood lighting, if used

Remarks on general appearance of exterior .....

A specimen of the special Survey Form which will be used in the Autumn Review of Shop-lighting Conditions in this country.

Sheffield Illumination Society

On Saturday, the 21st June, about 50 members and friends of the Sheffield Illumination Society visited Belle Vue, Manchester, for their annual excursion.

The journey was made by road, and a circular route was adopted, passing through some delightful Derbyshire scenery to Buxton, where a stay was made. Belle Vue was reached at midday, and the Zoological Gardens, in which are so many varied entertainments, proved a great attraction. Tea was served here, and afterwards some members took the opportunity afforded them of having a look round the centre of Manchester.

The party left at 6 p.m. after spending a most enjoyable and successful outing.

Doncaster Corn Exchange

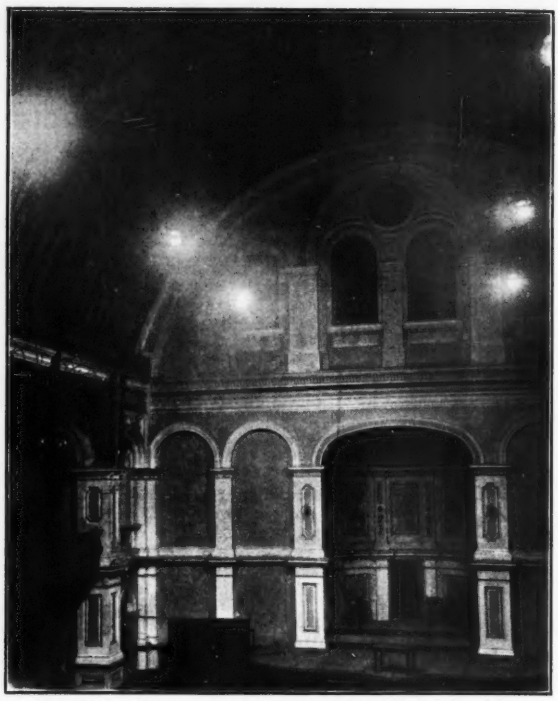
Gas Lighting as a Preventive of Cold Down-draughts

(Communicated.)

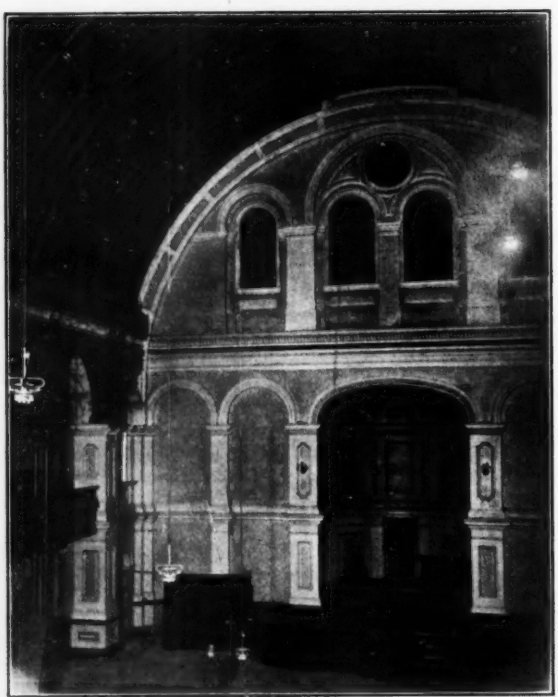
UNDER the heading "Corn Exchange Terror Exorcised," the *Doncaster Gazette* for March 14th last contained the following notes.

"The testimony paid by a Labour Town Councillor to the improvement in the atmospheric conditions inside the Doncaster Corn Exchange is well deserved. The place has not so far been tested by such arctic conditions outside as we had on many nights last winter, but I think it may be taken for certain that even with snow on the roof there would not be those blood-curdling down-draughts which in years past have often made attendance at Corn Exhange concerts a veritable torment—and a temptation of Providence. Although the central heating installation has been increased by the addition of eight hot-water radiators, the credit for the remedying of the down-draughts really belongs to our Gas Department.

"Six clusters of twenty gas burners each, suspended in two rows about fifteen feet below the roof principals, serve the double purpose of supplying light and keeping the ascending warm air from being chilled by the cold glass roof. Thermometer tests have shown an increase in temperature by 16 degrees above the gas clusters when these were lighted, as against only four degrees when they were not, other conditions being the same. The combined effect of the gas clusters and of the radiators has been to raise the temperature inside the hall to about 66 degrees, with an average temperature. And experiments with toy balloons have shown a noticeable absence of downward or sideway draughts."



A view of the Interior of the Doncaster Corn Exchange, showing some of the gas lights installed for the double purpose of preventing cold down-draughts and of lighting the building.



This flashlight photograph of the Interior of the Doncaster Corn Exchange shows some of the gas lamps lowered for maintenance purposes. Full details are given in the accompanying notes.

Mr. Robert Watson, Engineer and General Manager of the Doncaster Corporation Gas Works, has very kindly sent us the following additional information* regarding this installation of gas lamps, which not only prevents down-draughts of cold air in the Corn Exchange, but now provides the main lighting for the building:

The Corn Exchange, which is frequently used for meetings, concerts, and like functions, measures 80 ft. by 85 ft. and has a seating accommodation of 1,600.

Discomfort has been experienced in this building due to its generally low temperature, and more particularly to the cold and unpleasant draughts from the roof.

Eight low-pressure water radiators have been added to the existing central heating installation, these being fixed on the N.E. wall, where most of the cold winds impinge. The down-draughts are probably caused by the fact that air, although warm at floor level, rises and striking the cold roof results in miniature storms and in downward currents.

To overcome the latter trouble six clusters of gas burners have been installed for the purpose of warming the surrounding air, and thus preventing the downward flow.

The gas clusters each consist of twenty small (No. 2) burners, and are suspended in two rows about 15 ft. below the roof principals and some 40 ft. above floor level. They are equipped with two distant control taps —one for each row of three clusters fixed near the gallery doors. The taps permit of the gas being switched on and off without difficulty.

For cleaning purposes and renewal of mantles when required, each cluster is furnished with special gear, consisting of a cylinder and piston joint, suspension cable, and a winch fastened on the side wall. By means of this gear, the pendant pipe and gas burner cluster can be detached and lowered to the ground, and subsequently raised to its proper position with automatic jointing.

Each cluster lamp is provided with a small cup containing solidified methylated spirit. This is lighted and gives a flame lasting sufficiently long to permit of the re-ignition of the by-pass jet of the cluster when it is raised and reconnected.

The six lamps yield light of approximately 6,000 candle-power and together cost 1s. 7½d. per hour to run.

In order to test the efficacy of the gas installation for the avoidance of draughts, a maximum and minimum

* Readers will recall that in our last issue a short descriptive note, relating mainly to the lowering gear used in this installation, appeared (p. 187). The present article, however, deals with the special problem in ventilation which this lighting installation was instrumental in solving.—ED.

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STREET LIGHTING
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CONTENTS

A fully descriptive and beautifully illustrated booklet showing latest designs in:—

Prismatic Refractors
Street Lanterns
Lamp Standards and Brackets

This list gives very full technical data relating to the latest practice in street lighting and a very full abstract of the British Standard Specification for street lighting.

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reading thermometer has been suspended some eight feet above the level of the cluster lamps. A number of experiments show that an increase in temperature of some 16 degrees has been obtained, compared with an increase of four degrees when the gas clusters were not used, other conditions being the same.

Toy balloons hung at the same height indicated a definite upward movement of the air. A similar balloon held on a silk thread well below the gas clusters, while tending upward, showed no perceptible side or other currents which might cause draughts.

These tests appear to indicate that downward currents of cold air are avoided under the new conditions.

The combined effects of the gas clusters and of the radiators have been to increase the heat inside the hall to something approaching 66 degrees with an average outside temperature.

Since these fittings have been introduced there have been several functions held at the Corn Exchange, and considerable satisfaction has been expressed as to the result of the attention which has been given to the ventilation and heating.

FIG. 1.—Showing the Floodlighting of the Regal Cinema, Marble Arch.

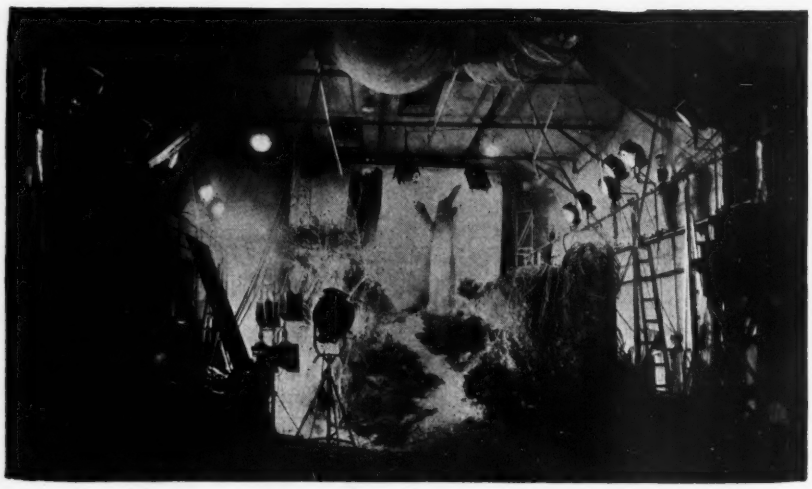
FIG. 2.—Showing Floodlighting of the Streatham Hill Kinema Theatre.

The Floodlighting of Kinema Theatres

The art of the kinema theatre is essentially dependent on the use of artificial light, not merely for the production and display of the film, but for the internal and exterior lighting of theatres. We are indebted to Messrs. Korting & Mathiesen Electrical Ltd. for the two accompanying views of theatres which have been effectively floodlighted. The Regal Theatre at the Marble Arch (Fig. 1) is a familiar object to Londoners. As the illustration shows, the effect of the series of 500-watt Kandem floodlight projectors is highly effective. Similar units are adopted for the Streatham Hill Theatre (Fig. 2). An interesting feature of the latter illustration is that the floodlights mounted at the top of the canopy over the main entrance are not switched on. These floodlights, which are designed to light up the front of the columns, are not frequently in use, as it is found that if the front of the column is left in darkness the contrast with the inner part of the loggia, likewise illuminated by several 500-watt projectors, is more vivid. On either side of the main entrance there are three similar projectors which serve to illuminate the front.

An Interesting Kinema Studio Installation

In view of the recent discussion before the Illuminating Engineering Society on the lighting of kinema studios the adjacent picture, for which we are indebted to *The Bioscope*, is of interest. This shows a combination of K. & M. incandescent broadsides, overhead lights, spotlighting units, etc., in use in the British Lion Studios at Beaconsfield. As is well known, Messrs. Korting and Mathiesen Electrical Ltd., besides being in the front rank of designers of incandescent units, make a special feature of arc lamps for photographic and kinema use, and many varied types of "Efa" units are available. For a time the introduction of "talkie" films gave a strong impetus to the use of incandescent lamps on account of their noiselessness. It is now being found, however, that by an ingenious arrangement of chokers arc lamps, which have certain inherent advantages for the making of films, can be rendered silent, and we understand that the K. & M. film arc department is again extremely busy.



A Scene at the British Lion Studios, Beaconsfield, showing a combination of K. & M. (Efa) Incandescent Broadsides, Overheads, Spots and Illuminators.

It seems to be now generally recognized that in dealing with scenes at kinema studios both arc lamps and incandescent lighting units can be used with advantage, and a well-equipped studio will have both forms of illumination at their disposal.

3296

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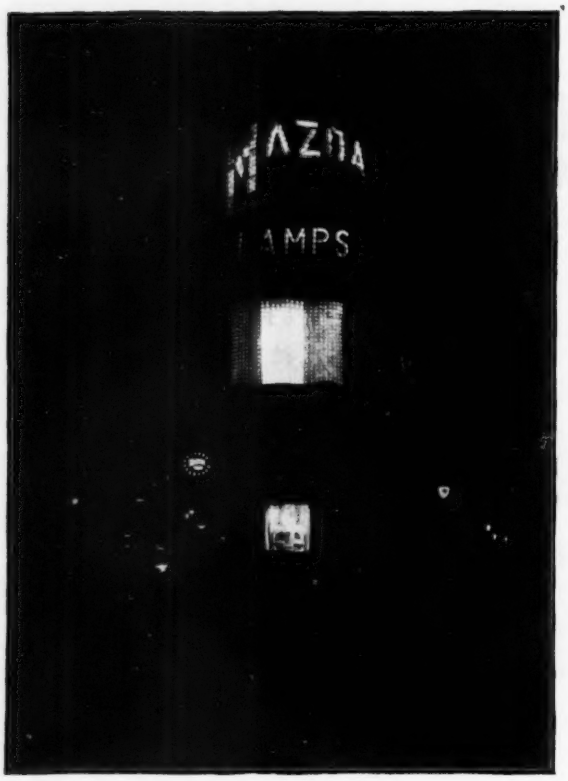
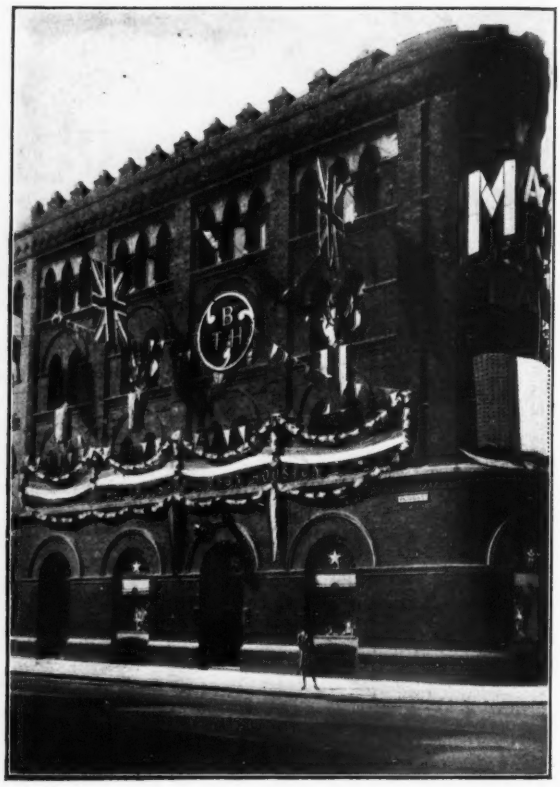


MAZDA LAMPS AND THE FRENCH FLAG.

The huge illuminated French flag fixed on the point of the Mazda Lamp Depot (a " flat iron " building), during Bristol French week, was the chief feature of the town decorations and attracted a tremendous lot of attention. The flag was formed of six hundred Mazda lamps (200 blue, 200 white and 200 red) mounted on a tricolour background.



FRENCH WEEK AT BRISTOL.

The Mazda Lamp Depot in Bristol was gaily decorated during the recent Bristol French week. This photograph shows the display of bunting, but does not do justice to the windows, which were most effectively and appropriately dressed for the occasion.

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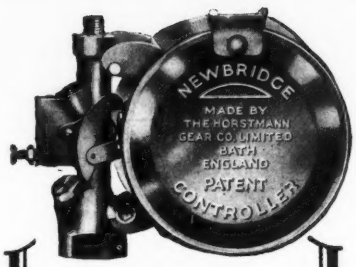

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FLOODLIGHTING THE VICTORIA AND ALBERT MUSEUM.

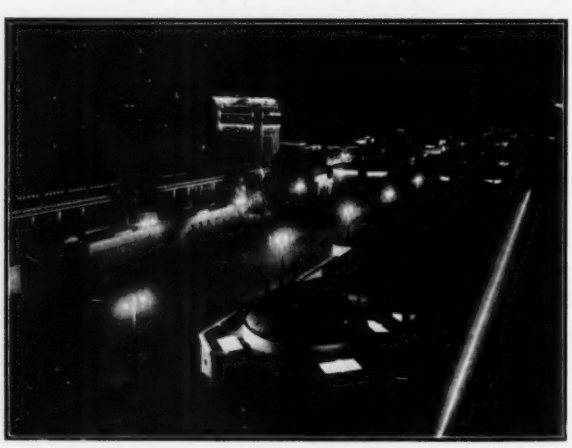
It has often been urged that more should be done to attract public attention to our museums. An enterprising step in this direction has recently been taken in the floodlighting of the entrance to the Victoria and Albert Museum, South Kensington. This is now illuminated at night by floodlights equipped with 200-watt lamps, supplemented by 150-watt units in silvered glass reflectors at either side. The accompanying illustration, obtained from an untouched night photograph, gives a good idea of the effect. A special troughing, which conceals the equipment, is fitted with a clear glass top to render the installation waterproof. We understand that His Majesty's Office of Works conceived the idea of adopting this form of floodlighting in order that visitors to Hyde Park, inconvenienced by bad weather conditions, might be induced to pay a visit to this wonderful museum, which is now open until 9 p.m.

The lighting was designed by the Illuminating Engineering Department of the General Electric Co., Ltd., and the actual work was carried out by H.M.O.W., who deserve congratulations on their enterprise.

TWO INTERESTING STREET LIGHTING INSTALLATIONS.

A view of the Plaza Congreso, Buenos Ayres.

The recent "International Street Lighting" issue of *Holophane Illumination* contains an introductory review of street lighting and a series of well-illustrated notes descriptive of Holophane public lighting in various parts of the world. Numerous installations in the United Kingdom are shown, and views of public lighting in leading cities in Australia, South Africa, Egypt, India, France, Belgium, Greece, Germany, Sweden, Italy, Poland, Czecho-Slovakia, Argentine and the United States are described. Many of these make use of very considerable numbers of lighting units. We have selected



A night view of the Avenue Gallieni during the Exposition de Arts Decoratif.

two particularly pleasing installations, the view of the Plaza Congreso, Buenos Ayres (where nearly 30,000 Holophane units of various types have been installed), and the Avenue Gallieni, Paris, which makes a very effective night picture. In many cases lanterns of the ornamental type have been adopted, one particularly striking instance being the Church Street Bridge, Melbourne.

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ILLUMINATING ENGINEERING AND ATHLETICS.

Illuminating engineering and athletics are associated in the person of Mr. K. C. Brangwin, who is the lighting engineer for Benjamin Electric Ltd. in the East Midland area, and is also the new amateur quarter-mile champion. Mr. Brangwin is entitled to this description as a result of his fine effort at Stamford Bridge on July 5, when the jubilee meeting of the Amateur Athletic Association was held. His time for the quarter-mile was within 1-3/10 secs. of the best previous performance in 1889. In the report of the meeting in *The Times* Mr. Brangwin is described as the outstanding man at the meeting and "a real discovery." We understand that he has been invited to represent England at the Empire games to be held in Canada during this month.

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CHANGES OF ADDRESS

PHILIPS LAMPS LTD., London Office, announce that from July 21st onwards, their trade counter will be moved from 145, Charing Cross Road, W.C.2., to 6A, Ridgmount Street, W.C.2 (turning off Store Street, off Tottenham Court Road).

Messrs. J. F. CROWLEY AND PARTNERS have removed from 11, Queen Anne's Gate. Their new address is Westminster House, Great George Street, Westminster, S.W.1.